



FRIDAY, MAY 8, 1896.

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Contributions.

The Texas & Pacific Decision.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The common sense answer to your question, how much more ought to be charged on freight from Liverpool to San Francisco via New Orleans than via Panama or via Cape Horn, is, as it seems to me, given in Colson's admirably lucid book "Transports et Tarifs." Says Colson, in effect:

The rates which are charged between New York and San Francisco via New Orleans have in the first instance nothing to do with the question. So long as in fact only a portion of the traffic from Liverpool to San Francisco is induced to travel via New Orleans, it is evident that the New Orleans route is charging all it can get for its additional speed and convenience. It is therefore giving no favor to the Liverpool shipper. If, however, the whole or practically the whole of the Liverpool and San Francisco traffic be induced to come via New Orleans, it is evident that this route is giving the traffic advantages it cannot get elsewhere at the same price. In other words the rate as against New York has become a preferential one, and is unjustifiable from the economic standpoint.

W. M. AC WORTH.

Railroad and Traffic Matters in Colombia.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice a communication in your issue of April 3, from a correspondent at Barranquilla, Colombia, giving certain figures regarding the import and other traffic of Colombia. These figures are quite incomplete and are apt to mislead those not well informed as to existing conditions in Colombia. I therefore venture to supplement the figures of the tonnage passing through Barranquilla, which your correspondent gives, with statistics (which were perhaps not available to him when he wrote), giving the tonnage arriving at Cartagena on the west coast, an ancient port, which is resuming its former importance since the opening of the Cartagena & Magdalena Railroad.

In November and December, 1895, the two months for which the business at Barranquilla is reported, the imports and exports going over the railroad company's pier at Cartagena were as follows:

November, Import.....	21,387 packages
Export.....	28,631 "
December, Import.....	26,229 "
Export.....	22,190 "

This, of course, is quite different from the 13,700 packages, which your correspondent gives as arriving at Cartagena in these two months by reporting the vessels calling at both Sabanilla (the port of Barranquilla) and Cartagena.

One other point in your correspondent's letter may be mentioned. He refers to the steamer Solidad, going over the bar of the Magdalena River at Barranquilla. That is not to be taken as evidence that the bar can be crossed safely by large ships. As a matter of fact, the Solidad was sent over the bar by the Cartagena-Magdalena Railroad more than two years ago with a light load of rails during the construction of the road. The boat was drawing less than 6½ ft. and had a capacity of less than 100 tons of rails. The boats trading with Colombia have a draft of from 16 ft. to 25 ft., and vary in tonnage from 2,500 to 6,000 tons, so that the steamer referred to, is not at all the type of boat that would be needed to enter the mouth of the Magdalena, if the river were navigable.

W.

Cartagena Magdalena Railway Company. }
CARTAGENA, April 17, 1896. }

TO THE EDITOR OF THE RAILROAD GAZETTE:

As a constant reader of your valuable paper I take the liberty of advising you to be very cautious as to the communications you publish from interested parties in this country, not that they are likely to do any serious harm, but the tissue of misrepresentation signed C. in your issue of April 3, from a man evidently afraid or ashamed

The Northwestern and the Union Elevated Railroads of Chicago.

(Continued from page 301.)

In the girder construction of the Northwestern Elevated road there are some notable departures from the standard dimensions, necessitated by partially clear spans at street intersections.

One of these, at Lincoln avenue, is worthy of special

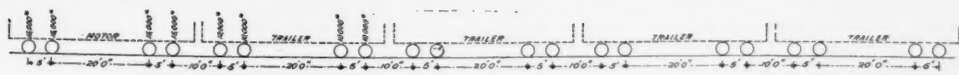


Fig. 10.—Diagram of Assumed Live Loads.

to publish his name in full is not creditable; but pray do not think that I propose to answer the writer's absurd statements which have been made as he says "although there is no census of this city (Barranquilla) to guide his calculations."

Mr. C. is perfectly well known to me, though not personally, I am happy to say, and if he will only oblige the public by sending his full name for publication it will be of itself quite enough comment on the value of his statements. He might also explain briefly what connection or communication he has had so far with either or both of the two rival railways of this section of the country to enable him to form such definite opinions, and what his business is at present in Barranquilla, since he classes Cartagena with "Maracaibo, Buenaventura and other smaller ports and the Isthmus of Panama." Verily it is a pity that he had not a "census" to aid his cal-

note. At this point the right of way crosses Lincoln avenue at an angle of 45 deg., two cable tracks occupying the street below.

To maintain an unobstructed thoroughfare it was necessary to construct two spans 47.10 ft. in length, supported at their farther ends by three columns and a transverse girder. One column is omitted, at each end, from the usual four, to clear the sidewalks. At the middle of the street the weight is taken by a single cross-girder of large proportions, supported at its extreme ends by a single column each, and braced by two heavy L struts that span the angles formed by the cross and longitudinal girders. An expansion joint lies directly over the center line of Lincoln avenue.

The large cross-girder is made up of a solid web of steel 58.40 ft. long, 84 in. deep, and 7/8 in. thick. It is flanged at top and bottom with two 6 in. x 6 in. x 90-lb. L's. It is re-enforced upon its top surface by three cover plates 16 in. wide x 5/8 in. thick, and one plate 16 in. wide x 1/2 in. thick, in lengths decreasing 6 ft. each, in successive layers, beginning with a plate that extends to within 6 ft. of the whole length at each end.

The bottom is strengthened in like manner by three plates, making the total depth 88 3/4 in. and the weight 32,400 lbs.

The longitudinal girders are each 47.10 ft. long, web 47 in. deep x 5/8 in. thick and are flanged in like manner to the cross-girder, with 5-in. x 3-in. 48-lb. L's. Their weight is approximately 5,780 lbs. each. The stiffeners and transverse braces here used are similar to those used upon the ordinary construction, and are fashioned in proportion to these larger girders. These spans are constructed to withstand a stress of 10,000 lbs. per square inch.

The standard structure is designed upon the basis of the load diagram shown in Fig. 10. Here there are distributed upon a total wheel base of 70 ft. for a motor car and one trailer, 100,000 lbs. of live load as follows: Each of four axles of an eight-wheel motor car sustaining 15,000 lbs. Each of four axles of an eight-wheel trailer sustaining 10,000 lbs., showing a live load per lineal foot, of single track, of 1,428 lbs.

A feature of the structure, proper, is the comparative lightness per lineal foot, four tracks wide. This weight is, approximately, but 1,600 lbs., thus effecting an economy of weight over structures heretofore erected. Attention may here be drawn to that which is considered to be the most essential feature of this structural work,

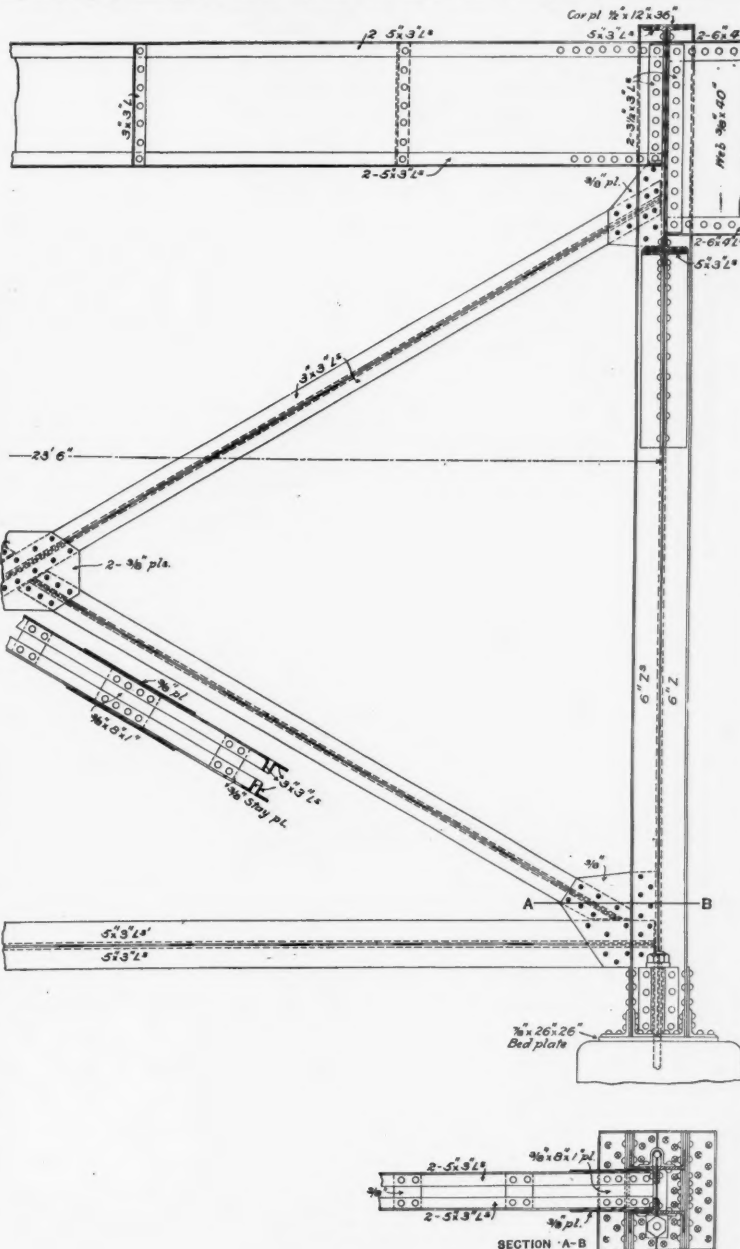


Fig. 11.—Longitudinal Sway Bracing.

culations as well as a handy book on geography, and several other "aids" which would have prevented his wretched display of ignorance and malice in the letter I refer to.

The Cartagena-Magdalena Railway, however, thanks him sincerely for his kind solicitude as to its investment and dividend paying qualities, and I am sure the stock of the Barranquilla Road ought to jump pretty high on such an estimate of its earning capacity from so eminent an authority as Mr. C.

J. T. FORD, Assoc. M. Inst. C. E.,
General Manager C. M. Ry. Co.

the "tower span," as shown in side elevation and cross-section in Figs. 11 and 12.

This tower span, designed to withstand the longitudinal sway of the structure caused by the stopping, but more especially by the necessarily abrupt stopping, of trains in transit, is here used for the first time in elevated railroad construction.

Referring to the last-named figures, it will be seen that this span, which occurs once in each four spans of structural length, is so designed as to receive upon its column heads any thrust that may be promulgated through the track which it guards. Through the diag-

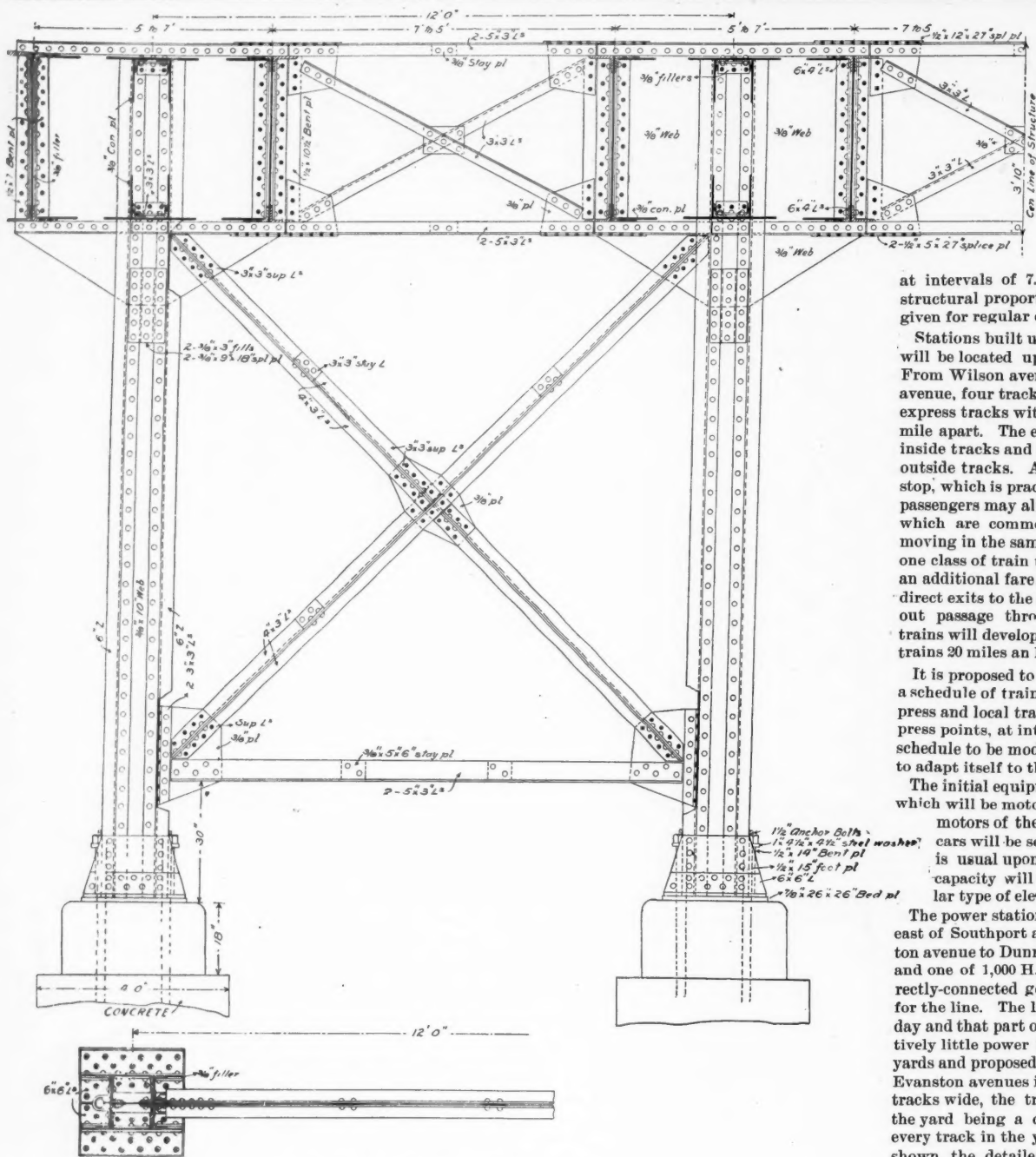


Fig. 12.—Detail of Transverse Sway Bracing.

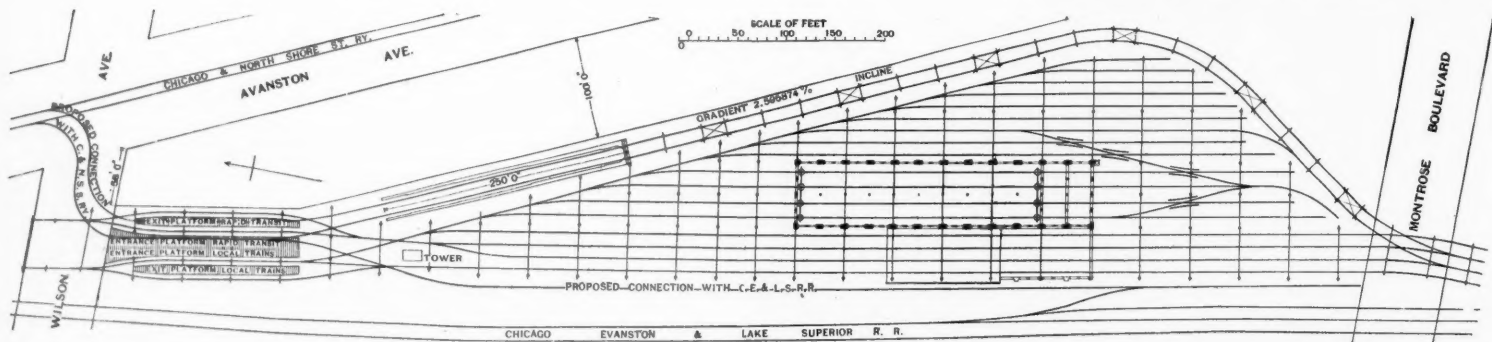


Fig. 16.—Plan of Yard, Northwestern and Union Elevated Railroads.

onal braces at its sides the thrust is transmitted directly from the column's top to the opposite column base. This relieves all columns of the horizontal bending strain that ordinarily is imposed upon them from this cause. The transverse bracing of the tower span being identical in principle, no given thrust or sway may extend farther than four span lengths, longitudinally, nor beyond 12 ft., the distance from center to center, in cross-section.

The value of this device, in withstanding the tendency to sway upon curves, by reason of the centrifugal force of moving trains at such points, will be at once apparent.

The tower span is built of four standard columns, as described, 23 ft. 6 in. distant from each other, longitudinally, and 12 ft. centers, in cross-section.

The girder is of solid web, 36 in. deep and $\frac{3}{4}$ in. thick, flanged with four 5-in. \times 3-in. 30-lb. L's. Four stiffeners of 3-in. \times 3-in. 21-lb. L's are equi-distantly placed in its length, and the column contact is made by four 3 $\frac{1}{2}$ -in. \times 3-in. 24-lb. L's. The longitudinal bracing is, at the bottom of the tower, four 5-in. \times 3-in. 28 lb. L's, laid in the form of a double T, with the stems turned inward. Ten $\frac{3}{8}$ -in. stay-plates are disposed equally distant in their length and riveted with them. The diagonal braces are

of 3-in. \times 3-in. 21-lb. L's, arranged also in two T's each, and covered and riveted at their intersection with two $\frac{3}{8}$ -in. connecting plates, 2 ft. 3 in. \times 1 ft. 4 $\frac{1}{2}$ in.

The transverse bracing is, at bottom, two 5-in. \times 3-in. 28-lb. L's, laid face to face, with their common plane downward and bound by two $\frac{3}{8}$ -in. \times 5-in. \times 6-in. connecting plates. The diagonal transverse bracing is made of two pairs of 4-in. \times 3-in. 24-lb. L's, crossed back to back, but meeting at their outer angles, with their backs upon the same plane. These L's are tied at four points by sections of 3-in. \times 3-in. 21-lb. L's, and at their intersection they are also riveted and joined by a connecting plate, as in the case of longitudinal bracing. The respective ends are received by corner plates of $\frac{3}{8}$ -in. web, where all are securely affixed, by riveting to the several portions of column to which they are directed.

The upper transverse bracing between girders is that ordinarily employed making a tower that is prepared to withstand a thrust attack from any direction. The resistance is offered directly upon the column line from both sides.

The deck structure of the road will be of yellow pine and suitable for the third-rail contact, system of electric motive power, with which the road will be equipped. Where boulevards are crossed ornamental spans will be

used, a side elevation and cross-sections of which are shown in Fig. 13. The outer facing upon the sides of the span is of 22-gage galvanized iron, and pressed zinc moulding. The under surface of the span is of corrugated iron, and the space between this surface and the deck of the viaduct is filled with asphaltic concrete, as a sound deadener. Ornament al columns 3 ft. 11 $\frac{1}{2}$ in. high,

at intervals of 7.2 ft., adorn the span in profile. The structural proportions are based upon the load diagram given for regular construction.

Stations built upon the plans shown in Figs. 14 and 15 will be located upon an average of four to the mile. From Wilson avenue, the north terminus, to Chicago avenue, four tracks will be used, two of which will be express tracks with stations, as shown in Fig. 14, one mile apart. The express trains will be run upon the two inside tracks and the local trains will be run upon the outside tracks. At every point where express trains stop, which is practically at every fourth local station, passengers may alight upon either of the two platforms, which are common to both express and local trains moving in the same direction, and be transferred from one class of train to the other without the payment of an additional fare. All stations will be provided with direct exits to the street from the station platform, without passage through the station building. Express trains will develop a speed of 40 miles an hour and local trains 20 miles an hour.

It is proposed to run at the morning and evening hours a schedule of trains at a 3-minute interval upon both express and local tracks. This will provide a train, at express points, at intervals of one minute and a half, the schedule to be modified by the system of swing trains to adapt itself to the needs of the balance of the 24 hours.

The initial equipment of the road will be 130 cars, 37 of which will be motor cars, driven by General Electric Co. motors of the "G. E. 2,000" pattern. The passenger cars will be somewhat lighter in construction than is usual upon elevated railroads, and their seating capacity will be slightly less than that of the regular type of elevated car.

The power station will be located on Fullerton avenue, east of Southport avenue, and will extend from Fullerton avenue to Dunning street. Three 2,000-H. P. engines and one of 1,000 H. P. will drive the general electric directly-connected generators, which will supply current for the line. The lighter engine is intended for the mid-day and that part of the night operation when comparatively little power is required. A plan of the terminal yards and proposed surface connections at Wilson and Evanston avenues is shown, Fig. 16. These yards are 17 tracks wide, the track which skirts the eastern side of the yard being a continuous lead track, opening into every track in the yards. Two other, central, leads are shown, the detailed connections of which are not yet established. In addition to the yards proper are two tracks upon the east side, laid upon an incline built of

structural iron and a retaining wall. This double track descends from the structure with a gradient of 2.50 per cent. to the terminal station upon the surface at the north end of the yards. The main lines of the road enter the station at elevated grade.

In the surface station, passengers from the allied surface lines will be received into the cars of the Northwestern Elevated express trains, bound cityward, and from northbound elevated trains connections will here be made, as shown, with the Chicago & North Shore Street Railway and the Chicago, Evanston & Lake Superior Railroad. The yards and shops will be two stories high and the shops will be provided with ample drop-tables. The shop plan is shown at the yard center.

The allied lines will include, in addition to the above mentioned roads and the Metropolitan, Lake Street, Chicago & South Side and Union Elevated roads, the North Chicago Street Railroad, the West Chicago Street Railroad and the Cicero & Proviso Street Railroad, with several proposed branches of the Northwestern Elevated road which are not as yet clearly defined. The Union Elevated Railroad is known in Chicago as "the down-town loop." It will be formed by the extension of the Lake Street Elevated Railroad that now occupies Lake street from Fifth avenue to Wabash avenue

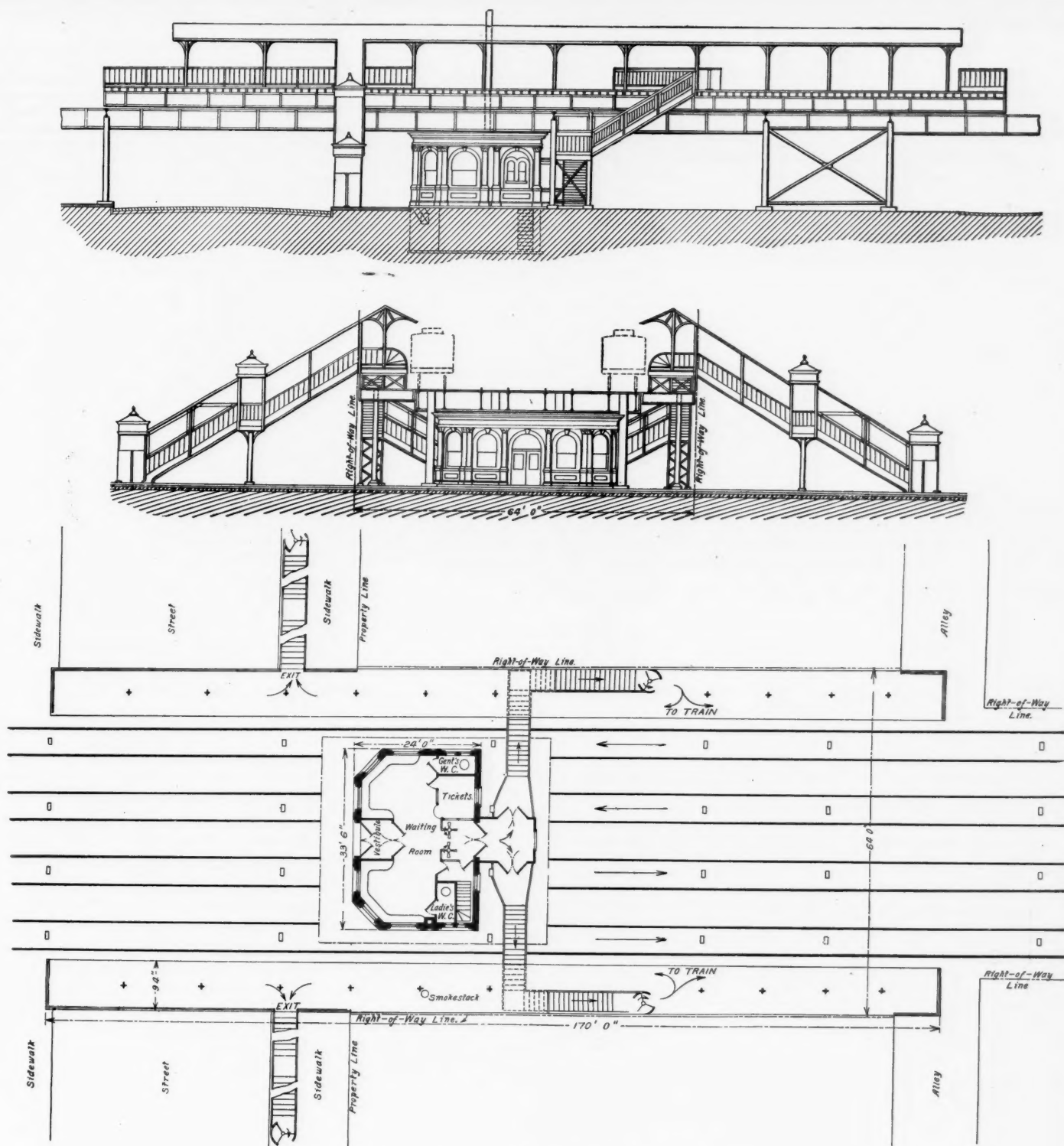


Fig. 15.—General Plan and Elevation of Exterior Platform Station.

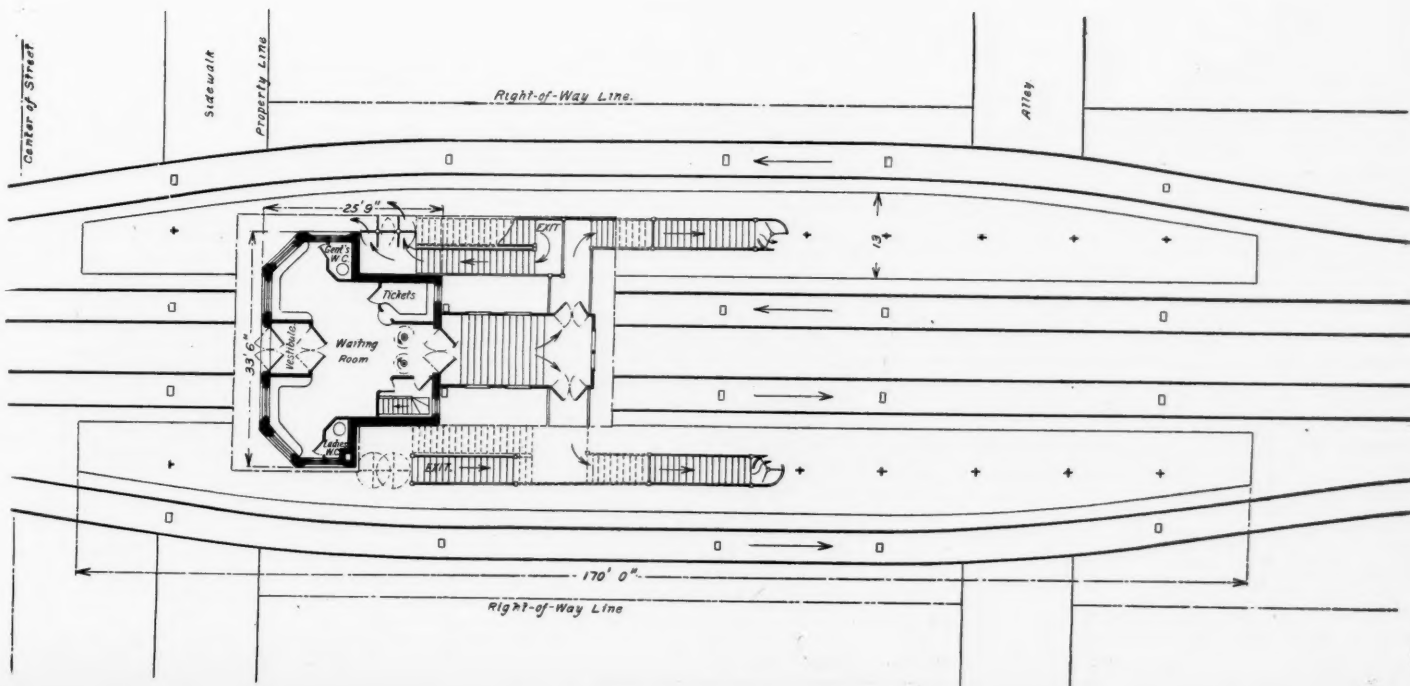


Fig. 14.—Plan of Interior Platform Station.

and the three sides of the loop that yet remain to be built. These will be built in Fifth avenue and Wabash avenue, from Lake street to Van Buren street, which will be the south side of the loop.

The Union Elevated Railroad will be a two-track structure, of the lattice girder type. The Northwestern Elevated road will be of like construction, south of Chicago avenue to its junction with the Union Elevated road, at Fifth avenue and Lake street. This junction of the structures will be made without stopping the operation of the Lake Street Elevated. The Union Elevated road will be used jointly by the Northwestern, the Lake Street, the Metropolitan and the Alley Elevated railroads. The two first named roads will use the outside track of the loop and the Metropolitan and the South Side Elevated roads will use the inside track. Trains will take the left hand tracks as they run. The situation on the Union Elevated Railroad is somewhat complicated in the matter of cross-overs at intersections, and these details are not yet worked out. The disposal of passengers alighting upon a station platform that is common to two roads is also a feature that will require special treatment. Nothing definite can yet be said of these features or of the plan and location of stations upon the Union Loop, except that a tunnel way will con-

end of the bridge, to sustain it upon the abutments when the bridge is at rest.

The Northwestern Elevated Railroad, with its proposed alliances, is a project of great magnitude. It is destined, under the management of Mr. D. H. Loudback, who is President of the road, to bear an important part in the building up of Chicago to the northwest. It is expected that trains will be run upon it within the current year.

We acknowledge the courtesies extended to the *Railroad Gazette* by Mr. Charles V. Weston, Chief Engineer of the Northwestern Elevated Railroad; Messrs. A. T. Tomlinson and J. N. Darling, Assistant Engineers; and Mr. J. A. L. Waddell, Consulting and Designing Engineer, in furnishing necessary data and drawings for the preparation of this article.

Why Do Rails Break.*

The more modern rails, when worn to a certain extent, will break crosswise, a rail breaking sometimes into several pieces. The Kaiser Ferdinands Nordbahn, an Austrian trunk line, uses rails of basic Martin steel of two sections, weighing 62½ lbs. and 71¼ lbs. per yard. They wore so fast that breaks were to be anticipated.

(d) from the base, less strengths, greater elongation. These facts are expressed more exactly in the table below.

The second series proved furthermore, that the strength is pretty even all over the section near that rail end which is rolled from the lower end of the ingot, but that the differences increase as the other end is approached. The tests seem to disprove the opinion that as in rolling more work is exerted on the web than on the flanges, and again more on the flanges than on the head of the rail, therefore these degrees of effort correspond to different ultimate resistances and that the web is stronger than the flange and this is stronger than the head of the rail. They also seem to disprove the theory of the rolling process increasing the density of the material near the surface of the rail.

For etching a weak solution of muriatic acid was used. The faces of the test pieces were carefully polished with emory and all pieces then simultaneously immersed. All of them, and a great many others tested at other times, have in common a clearly defined division of the material into an outer shell and a core, Fig. 2. Sometimes both are homogeneous structure and are then distinguishable only by their different color; oftener, however, will the core appear worm eaten by the etching,

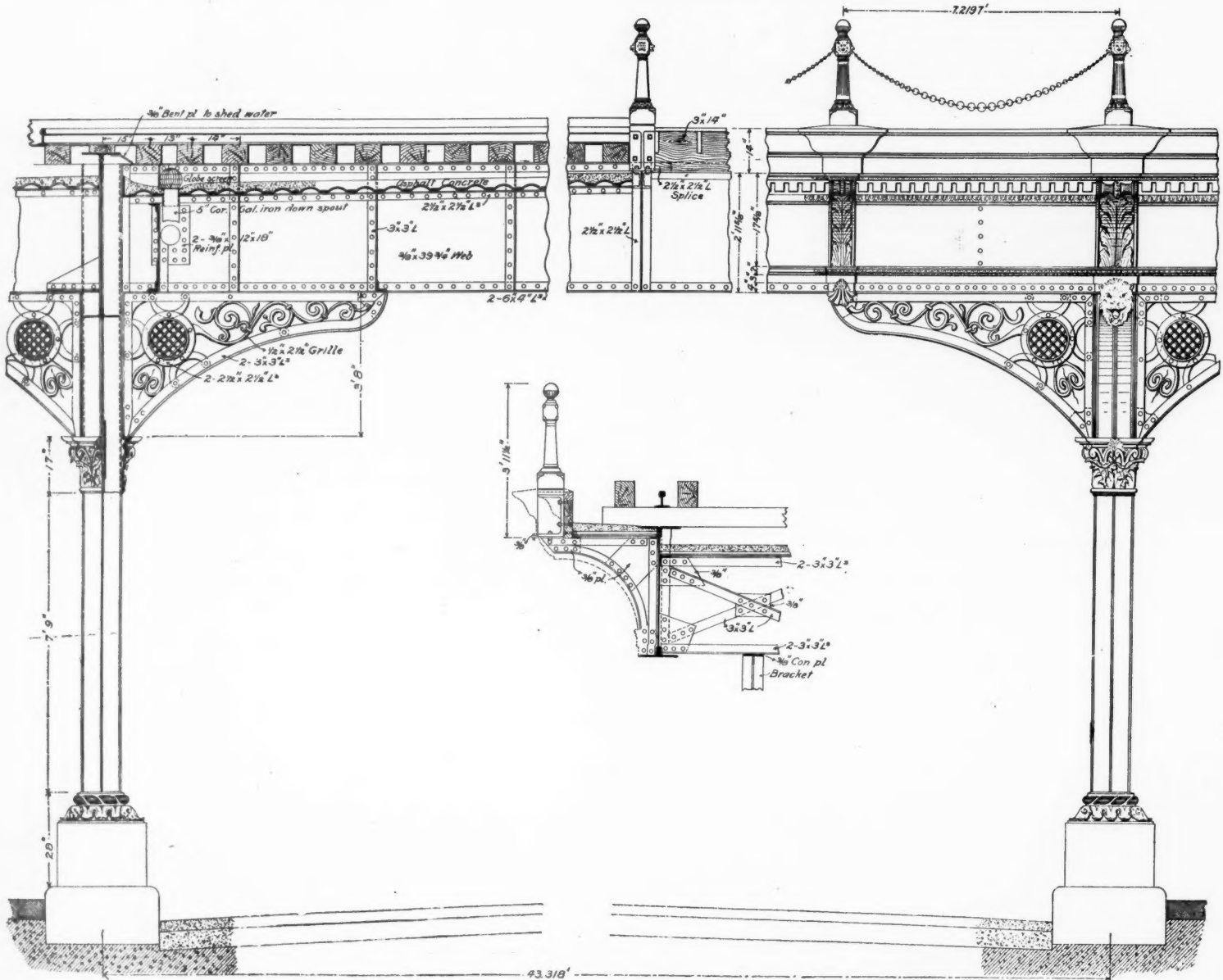


Fig. 13.—Boulevard Crossing.

nect the Union station platforms, just below the girders. The station architecture will, like that of the Northwestern Elevated road, be suggestive of the Gothic style.

The most serious hindrance to the successful operation of a joint schedule for these four roads, upon two tracks, lies in the fact that three of them cross the Chicago River upon drawbridges. A boat passing from the lake into the south fork of the river will "bridge" three of the four roads. Every boat that goes up the channel to either fork of the river will "bridge" the Northwestern Elevated road. Temporary congestions upon the loop are therefore quite possible, but the problem will no doubt yield to intelligent treatment.

The Wells street bridge, upon which the Northwestern Elevated road will cross the river, spans the main channel of the Chicago River. The chords of this structure are found to be strong enough without alteration. The web and the revolving drum will be increased in dimensions. Two courses of masonry will be removed from the pier, and the depth of the revolving drum will be increased from 20 in. to 48 in. Electric motors to drive the swing gearing, will be mounted upon the radial struts of this drum, and a small, independent motor will operate the lifting screws under each

The resulting feeling of uneasiness and incongruities observed in the results of drop, bending and pulling tests (rails, for instance, which appeared brittle and hard when pulled being found to endure very severe drop tests), induced Regierungsrath Ast to submit such rails to a series of pulling, etching and analytical tests to determine whether their behavior was due to a want of uniformity in material. Fifteen rails rolled in 1893 were thus tested. The process of manufacture is detailed in the paper and the results of the tests are tabulated, also those of a second series of tests, where test pieces were cut out of the full, 3-rail bar about 5 ft., 35 ft. and 65 ft. from the end. The test bars were cut from the rails in the places shown in Fig. 1. The comparative results of the first series of tests are thus stated. Test bars.

- (a) from top of rail, have less strengths but greater elongation.
- (b) from center of head, have greater strengths but less elongation.
- (c) from the web, have greater strength, greater elongation.

and the holes are sometimes strung out like beads on a chord. The shell is always homogeneous.

The chemical analyses of the test bars were twice independently checked. The strength was found to be greater in the bars having more foreign ingredients. Some of the analyses are as follows:

		Carbon.	Silic on.	Manga- nese.	Phos- phorus.	Sul- phur.	Copper.
1.	a	0.411	0.011	0.477	0.063	0.026	0.130
	b	0.525	0.007	0.506	0.104	0.038	0.126
	c	0.485	0.010	0.506	0.099	0.040	0.123
	d	0.456	0.009	0.488	0.064	0.025	0.109
3.	a	0.390	0.013	0.500	0.063	0.033	0.131
	b	0.480	0.014	0.494	0.089	0.041	0.152
	c	0.456	0.009	0.500	0.079	0.037	0.120
	d	0.472	0.014	0.511	0.076	0.035	0.110
5.	a	0.357	0.010	0.412	0.057	0.039	0.122
	b	0.501	0.006	0.430	0.099	0.057	0.139
	c	0.507	0.011	0.430	0.102	0.063	0.116
	d	0.459	0.014	0.407	0.063	0.033	0.105
9.	a	0.294	0.012	0.442	0.028	0.018	0.134
	b	0.504	0.016	0.500	0.062	0.045	0.152
11.	a	0.351	0.028	1.146	0.045	0.019	0.140
	b	0.681	0.023	1.239	0.084	0.021	0.135

* From a paper read by A. R. V. Dormus before the Austrian Soc. C. E. Condensed from the *Zeitschrift des Oest. Ing. und Arch. Vereins*, by Julius Meyer, C. E.

For comparison the specifications of the N. Y. C. & H. R. R. Co. are as follows:

	65 lbs.	70 lbs.	75 lbs.
Carbon.....	0.45 to 0.55	0.47 to 0.57	0.50 to 0.60
Silicon.....	0.15 " 0.20	0.15 " 0.20	0.15 " 0.20
Manganese.....	0.80 " 1.00	0.80 " 1.00	0.80 " 1.00
Sulphur not to exceed.....	0.069	0.069	0.069
Phosphorus not to exceed.....	0.069	0.060	0.060

In the 80-lb. rail the carbon of the New York Central specifications is 55 to .60, and in the 100-lb. it is from .65 to .75.

The results of pulling tests of these same rails are as below :

TESTS OF MARTIN STEEL RAILS ; PRODUCT OF 1893.			
No.	Place from which test bar was cut.	Ultimate breaking load in lbs. per sq. in.	Elongation ; per cent.
1.....	a	83,489	18.6
	b	92,023	6.0
	c	96,431	14.7
	d	86,334	8.0
3.....	a	85,765	14.7
	b	96,289	19.3
	c	95,720	19.3
	d	92,450	20.0
5.....	a	80,073	17.4
	b	89,178	6.0
	c	94,587	17.3
	d	85,765	17.3
9.....	a	70,119	26.0
	b	84,493	4.0
11.....	a	82,066	22.0
	b	112,067	12.0

For further comparative study we give below in full the results of the tensile tests.



Fig. 5.

TESTS OF MARTIN STEEL RAILS ; PRODUCT OF 1893.
Each Group is a Separate Heat.

Place from which test bar was cut.	Breaking load ; kilograms per sq. mm.	Elongation ; per cent.	Place from which test bar was cut.	Breaking load ; kilograms per sq. mm.	Elongation ; per cent.
a.....	53.7	18.6	c.....	60.0	20.7
b.....	64.7	6.0	d.....	56.0	28.0
c.....	67.8	14.7	a.....	49.3	26.0
d.....	60.7	8.0	b.....	58.0	4.0
a.....	55.7	22.0	c.....	65.0	16.7
b.....	58.6	19.3	d.....	51.8	27.3
c.....	58.0	24.7	a.....	52.5	6.0
d.....	57.3	20.0	b.....	65.7	9.3
a.....	69.3	14.7	c.....	61.0	2.0
b.....	67.7	19.3	d.....	62.3	18.0
c.....	67.3	19.3	a.....	57.7	22.0
d.....	65.0	2.0	b.....	78.8	12.0
a.....	55.6	13.3	c.....	74.2	14.7
b.....	60.0	16.7	d.....	62.2	22.0
c.....	59.0	22.6	a.....	58.4	26.0
d.....	59.0	24.0	b.....	62.0	24.0
a.....	56.3	17.4	c.....	59.8	24.0
b.....	62.7	6.0	d.....	61.5	22.7
c.....	65.8	17.3	a.....	53.3	28.0
d.....	69.3	17.3	b.....	54.0	26.7
a.....	54.0	23.3	c.....	55.2	26.7
b.....	60.2	20.0	d.....	55.0	21.3
c.....	58.3	23.3	a.....	65.0	16.0
d.....	57.5	23.3	b.....	67.2	21.3
a.....	51.8	28.7	c.....	66.3	24.0
b.....	57.5	22.0	d.....	68.3	19.4
c.....	56.0	18.0	a.....	55.5	22.0
d.....	52.0	25.3	b.....	58.0	20.7
a.....	53.5	25.3	c.....	57.8	24.0
b.....	60.3	16.7	d.....	57.8	25.3

The three kinds of tests taken together seem to prove that the great differences in strength occurring in the same rail section are caused by segregations in the ingots. It stands to reason that the homogeneous shell A, Fig. 2, of the rail corresponds to the rapidly hardening outside, and the core J of the rail to the slowly hardening core of the ingot. The material of A may be called shell steel; that of J, core steel; the surface separating

the two, the hardening surface, or in the section, the hardening contour. The shell as well as the core seems

the chemical composition of the liquid steel and the pouring temperature resulting therefrom. The shell will be the thicker the nearer the temperature of the steel in the converter approaches the temperature of hardening. Conditions may make it therefore advisable to let the steel get stale in the ladle, which facilitates the escape of the gases, and some advocate the agitating of the metal for the same purpose. [P. H. Dudley, in the N. Y. C. specifications, requires a green wood pole to be

TESTS OF MARTIN STEEL RAILS ; DELIVERY OF 1895.				
In these tests the specimens were cut from the three-rail bar as it came from the rolls before sawing. Every three groups is from one heat.				
Length before sawing ; meters.	Distance of test-piece from end of bar ; meters. (This end corresponds to bottom of ingot.)	Place from which test bar was cut.	Breaking load ; kilograms per square mm.	Elongation ; per cent.
30	1.5	a	56.4	14.0
		b	58.0	15.0
		c	58.0	23.0
	10.5	a	5.6	11.5
		b	58.3	16.5
		c	59.7	21.0
	19.5	a	57.3	14.5
		b	60.3	14.5
		c	62.5	20.0
30	1.5	a	57.3	22.5
		b	57.3	22.5
		c	58.0	23.0
	10.5	a	57.9	19.0
		b	57.9	20.0
		c	57.7	23.0
	19.5	a	56.0	23.5
		b	57.6	20.5
		c	57.0	20.5
30	1.5	a	50.0	22.0
		b	50.0	21.5
		c	51.0	24.0
	10.5	a	52.0	16.5
		b	53.3	17.5
		c	54.4	22.0
	28.5	a	51.8	20.5
		b	58.0	5.0
		c	64.0	14.0
39	1.5	a	49.4	20.5
		b	50.3	21.0
		c	51.4	26.0
	19.5	a	51.0	19.0
		b	53.0	24.0
		c	53.0	26.0
	37.5	a	52.7	16.0
		b	48.8	12.5
		c	63.5	16.0
39	1.5	a	55.0	24.0
		b	53.0	20.0
		c	55.2	23.0
	19.5	a	53.6	19.0
		b	55.0	22.0
		c	55.3	22.5
	28.5	a	56.0	27.0
		b	58.6	16.0
		c	58.5	18.5

each to have a chemical composition of its own, which again is practically, unvaried all over the shell and all over the core.

It is apparent that the tabulated figures of strength do not represent the true inwardness of the case where test bars are cut partly from the shell and partly from the core (Figs. 3 and 4). The highest test figures are obtained from bars taken from the web, which contain mostly core steel, and, therefore, show great strength, and because the two layers of tough shell steel on the outside protect the surface of the bars against injury, that is, against premature pulling. Exceptional test figures may result from local segregations; rolled out the latter produce hard and brittle veins, which, when they come to the surface of a test bar, having less elongation, will weaken its surface and cause it to break prematurely. The tables prove the great reliability of the pulling test, by which the homogeneity of the steel can be better gaged than by chemical analysis, because the sum of allowed inaccuracies in the analysis may produce noticeable differences in strength, and because only a few substances are followed up in the analysis. The chemical test figures of the tables do not either reflect the exact

the chemical composition of the liquid steel and the pouring temperature resulting therefrom. The shell will be the thicker the nearer the temperature of the steel in the converter approaches the temperature of hardening. Conditions may make it therefore advisable to let the steel get stale in the ladle, which facilitates the escape of the gases, and some advocate the agitating of the metal for the same purpose. [P. H. Dudley, in the N. Y. C. specifications, requires a green wood pole to be



Fig. 6.

thrust into the metal for 10 seconds.] The escape of gases continues in the mold. Fig. 7 is the vertical section of a Martin steel ingot of 1895 of 12½ in. x 14 in. cross-section. Figs. 8 and 9 are cross-sections of the center of two Martin steel ingots of 1893, of respectively 15 in. x 16½ in. and 6½ in. x 6½ in.

Though it is frequently claimed that the heat produced by the rolling process will weld the sides of the flaws where the same are not oxidized, yet rails in service and results from test bars prove unmistakably that the flaws are only flattened out in the rail. Flaws and segregations are equally harmful. Where cross breaks occur on rails in the track frequently old cracks are found in the core, which were quite unnoticeable from the outside. Figs. 10, 11, 12, 13 illustrate instances of internal breaks where the old cracks closely follow the hardening contour and appear on the surface only where the shell thins out, mostly at the web. The breaking of the core may be closely followed by the breaking of the shell, so that the whole profile has a new and even appearance, though frequently also in these breaks core and shell are clearly discernible. It will now be understood why rails will break by the occurrence therein of large segregations. These latter produce a very hard core steel, with sometimes hardly appreciable elongation, so that only the core carries and the section of the rail is really reduced to that of the core. Frequently, also, the core is richer in foreign admixtures, and especially in phosphorus, which renders it more sensitive to low temperatures.

Fig. 14 illustrates another frequently occurring break; the longitudinal splitting of the rail head, very likely caused by vibrations produced by the rolling load. Figs. 15 and 16 are instances of internal cleaving. Shell



Fig. 7.

conditions on account of the varying amount of shell steel and core steel in the test bars.

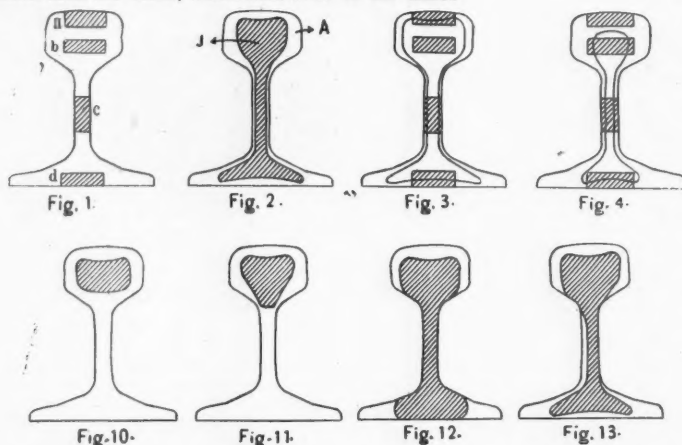
As regards the testing qualities of the rail it is apparent from the above that they are affected by the location of the hardening surface, the occurrence of more or less flaws thereon and by the segregations. Etching will reveal all that, and more attention than heretofore should be given to etching as a test. The etchings will make the core steel look rougher and, therefore, in most cases darker than the shell steel, if there have been no flaws and pipes in the ingot, while a pitted etch-surface proves that flaws and accumulations of segregations have been present therein. Fig. 5 is the etching of a Martin steel rail of 1893, having segregations equally distributed throughout the core steel. A greater number of flaws appear on the hardening contour. Fig. 6, a rail of the same material and same year, has the hardening contour clearly developed, but there is hardly any difference in the appearance of shell and core.

The location of the hardening surface is influenced by

shaped breaks in the head, Fig. 17, have been found by etching never to reach below the hardening surface and have their cause very likely in separations along the hardening surface caused by cold straightening which lead to breaks under the pounding and the vibrations of the load. The segregations also explain the flattening of the rail head, especially at joints, for a soft shell steel on a hard unyielding support must soon be flattened.

The number of rail breaks has been found by experience to be great in the early use of new rails; then it decreases, remains constant for some years and then increases again, often rapidly. The great number in the beginning is explained by defects of the material which lead to breaks at once. As the abrasion progresses the frequently brittle core comes nearer and nearer to the surface, until it is finally laid bare. At this juncture, and perhaps somewhat prior to it, the number of breaks increases again, and then the rails not only break, but are frequently broken up into little pieces. A thick crust of shell steel appears, therefore, desirable in the interest of

safety. But said facts also prove that the drop test is not an adequate method for testing steel, which is subject to considerable abrasion, at least, as long as a steel practically homogeneous and always alike is not to be obtained. Of two sets of rails manufactured alike and used under practically equal conditions the one will show, for a million tons of load, two and a half times more abrasion than the other, which rises even to six times



coupled with 10 times the number of renewals. The cause of it is, of course, that while the bars taken from the center of the head and the web may test up to the requirements, the steel on the top and sides of the head is below the requirements.

Though the chemical composition of the steel has much to do with the strength of the rail, yet rails of quite different composition have been found to give the

formula determining the tensile strength of steel from its chemical composition, based on the theory that each component part contributes to the strength of the material in the ratio of its atomic weight. His formula for the tensile strength is

$$Z = A + \frac{2}{3} C + \frac{2}{7} Si + \frac{1}{7} Mn,$$

wherein C , Si and Mn are stated in per mille and A is a constant depending on the tempering of the steel and its mechanical treatment. Von Jüptner calls his formula "a first approximation."

Regarding the influence of the rolling process upon the grain and strength of steel rails, the paper quotes extensively from papers on photographic and microscopic investigation of the structure of steel rails by Wedding and Martens of Berlin, Ormond of Paris, and Sauveur and Hunt of Chicago. The opinion is advanced that the rolling process has not that decisive influence upon the structure

of the steel rails which said writers ascribe to it. By distributing the inequalities of the ingot over a long beam they will become less apparent. They can be actually reduced by due caution in the blowing and pouring of the steel, by its mechanical treatment, the correct temperature in finishing and proper cooling.

If it is considered how many thousands of rail breaks occur annually, and how many millions of dollars are

requiring the greatest care in production and manufacture. The larger dynamic forces exerted upon the rails by the increasing train speed cannot be counteracted by forever increasing the weight of the rods and improving the track construction, but they should be met by improving the quality of the rails. At the present time the Austrian rolling mills cannot furnish a thoroughly uniform material. But the inequalities may be reduced

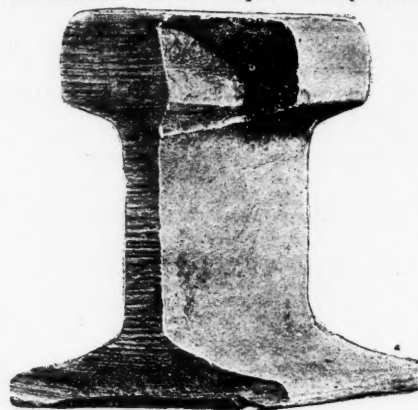


Fig. 14.

to a minimum. They were principally found at the upper end of the rolled beam reaching over $\frac{1}{8}$ to $\frac{1}{4}$ of its length. As the crop ends are only from 3 ft. to 5 ft. long, quite a considerable quantity of inferior material comes into use and the rails rolled thereof will break. If these rails of the upper $\frac{1}{8}$ are laid in side tracks there will have been selected for the main track an almost uniform rail material of the strengths and properties of the tough shell steel, and if it be basic Martin steel it will be possible to go to ultimate strengths of 85,000 lbs. and over without endangering the safety of operation. Thus a rail material would be obtained com

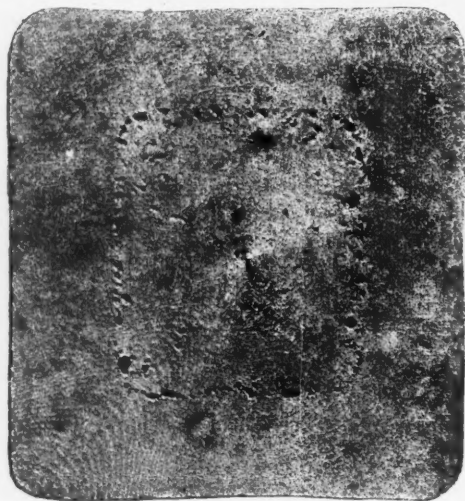


Fig. 8.



Fig. 9.

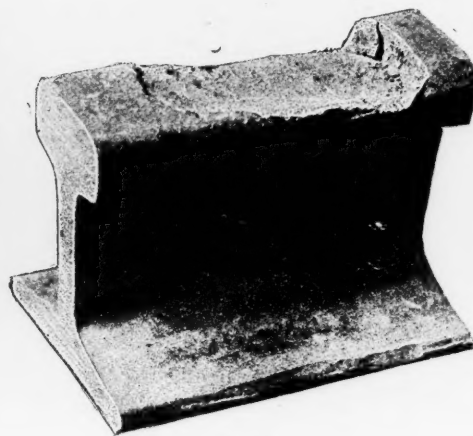


Fig. 17.

same service in the track under otherwise equal conditions. Considering also the great differences of raw material and of furnace practice chemical composition should be specified only to the extent of limiting the ingredients which produce segregations by stating the maximum allowed percentage of phosphorus in the top butt end of the rail as well as an upper and lower limit for silicon. All efforts at formulating the influence of

invested in steel rails every year, the desirability of experiments to clear up the questions here advanced must certainly be admitted. These experiments should embrace the finished product from all the processes of steel manufacture; but they should also be extended to the influence of large heats on the quality of the ingots, for

binning with greatest safety a great resistance against abrasion and therefore of greatest economy.

A Wonderful Flood.

Toward the end of 1893 a tremendous landslip occurred in the mountains in the northwest of India. It formed a



Fig. 15.



Fig. 16.

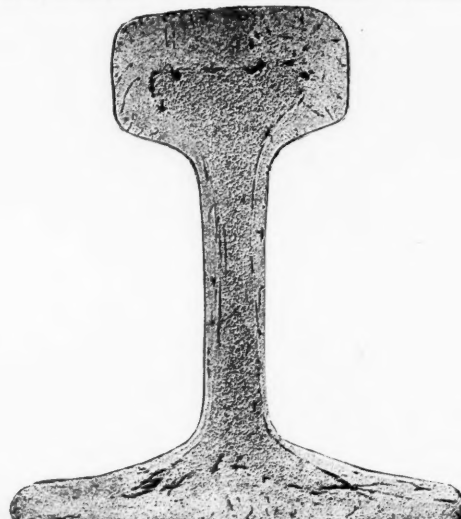


Fig. 18.

the chemical composition upon the strength of the steel suffered until quite recently from the mistake of considering carbon only. Webster in the United States and Von Jüptner in Germany took more elements into consideration. Webster's experiments upon the influence of carbon, sulphur, phosphorus and manganese have all been made with soft Thomas steel plates, and therefore do not apply generally. Von Jüptner constructs a for-

the first and last ingot will certainly be of different chemical composition; also to the influence of the size of the ingot, for the last ingots and the larger ingots will contain more segregations; also to the relation of the shape of the cross-section of the ingot to the rolling process; also to the influence of the chemical composition, the finishing temperature and the method of cooling.

Rail steel should be treated as a special material re-

dam across a mountain river, which dam was 900 ft. high, 3,000 ft. across the gorge on the top of the dam and 600 ft. at the bottom. It was about 2,000 ft. wide at the top and 11,000 ft. at the base. The mass of earth and rock which formed this dam came down from a height of 4,000 ft. above the bed of the stream. The dam formed a lake, covering a surface of about $1\frac{1}{4}$ square miles, containing, when full, about 16,650 million cubic feet.

As soon as this dam was formed it became obvious to the engineers of the British Government in India that a terrible catastrophe would result. The lake created was sure to fill in time, to flow over the top of the dam, the rushing water to cut away the dam and make a breach, causing a flood of probably unparalleled magnitude in the valleys below. Then they set to work to calculate the time at which this might be expected to take place, and wonderful to say the estimate of the date of the flood was in error only 10 days. The flood took place on Aug. 25, 1894; it had been predicted for the 15th, and it was calculated that 10,000 million cubic feet of water was discharged in four and a half hours.

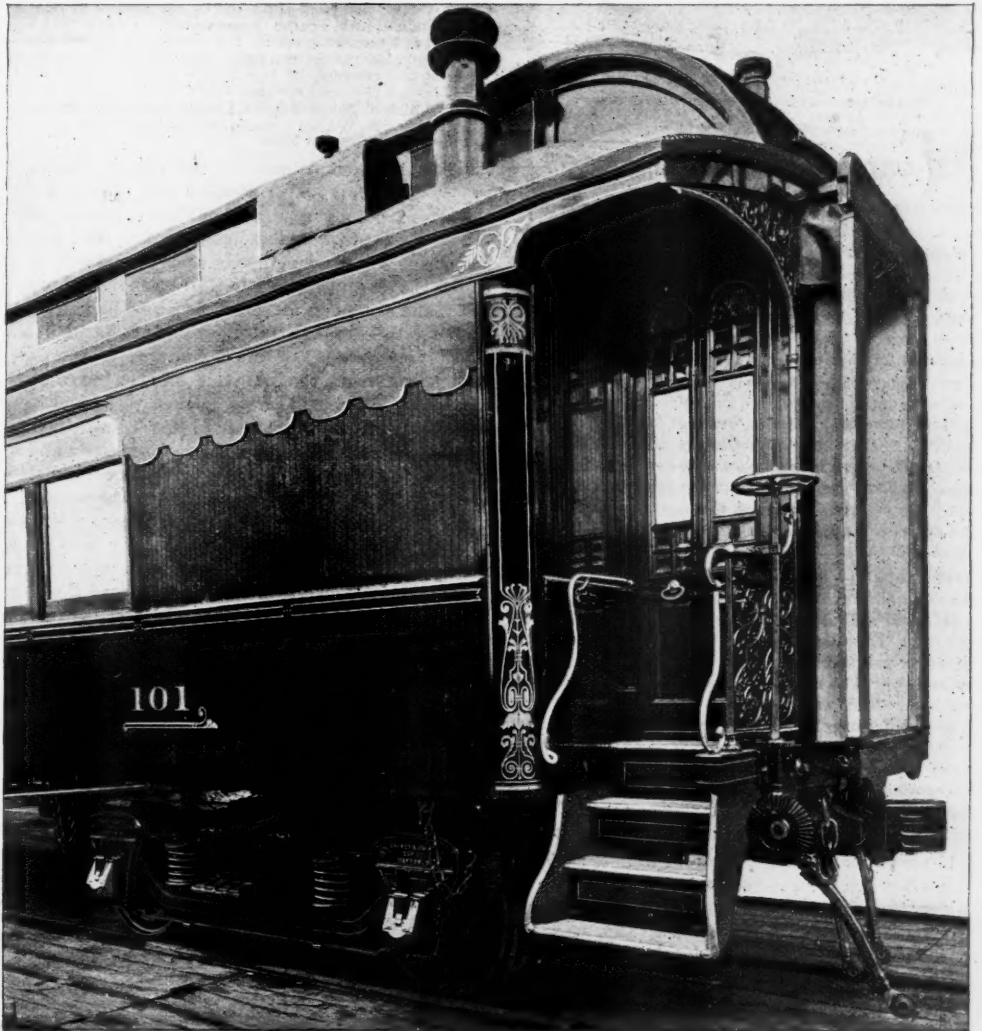
In the gorge, immediately below the dam, the flood rose 260 ft. The valley was filled with debris and the bed of the river was raised some 234 ft. Thirteen miles below, the river bed was raised 50 ft and the flood reached a height of 160 ft. above its ordinary level. For more than 50 miles down the valley the flood rose from 113 ft. to 140 ft. Seventy two miles down, at the town of Shrinagar, the flood was 42 ft. above ordinary flood level. This town was destroyed, and stone, sand and mud deposited over the area. Several small villages below, in the valley, which here opens out, were completely swept away. The flood reached Hardwar, 150 miles below the dam, on the morning of Aug. 26, the first flow over the top of the dam having taken place on the morning of the 25th. At this point it attained a height of 11 ft. above the ordinary flood level.

Astonishing to say, not a life was lost, except that of a fakir and his family, who obstinately remained in a dangerous place. The valleys below the dam had been covered with telegraphic signal stations. Stone posts, to mark the lowest level at which it would be safe to remain, had been set, and the people had been warned to retreat when danger was announced. Observers at the dam telegraphed the alarm down the valley in sufficient time.

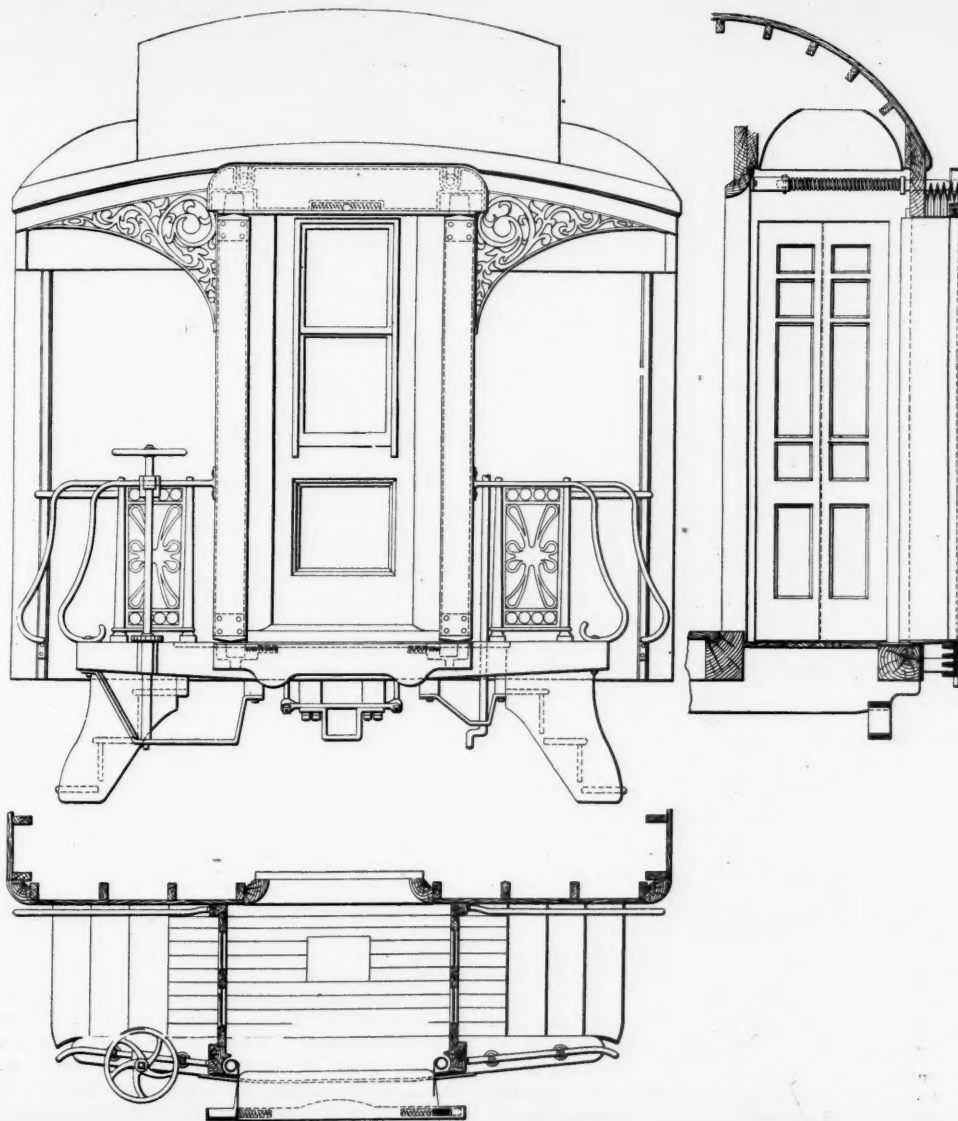
Moreover, comparatively slight damage was done to the great canal works. At Hardwar, 150 miles below the dam, are the head works of the Ganges Canal, and serious injury to these would have caused incalculable damage and suffering to the people below, not only in loss of life and property, but through the interruption of cultivation. But careful preparations had been made to protect these works. A massive dam was built of cribs filled with boulders, with embankments leading to the rising ground, to prevent outflanking of the head works. The head gates were strengthened and backs were built at various points lower down.

The total loss to the Government, together with the outlay in protective measures, amounted to 2,500,000 rupees. The loss to private individuals has not been estimated.

This certainly is a very remarkable example of intelli-



Chair Car Equipped with the Buhoup Vestibule.—K. C., P. & G. R. R.



The Buhoup Vestibule.

gent application of engineering knowledge and judgment, and also of the beneficent results of the English rule in India. We would recommend everyone, who has the opportunity to do so, to read the account of this flood which is published in *The Engineer* (London) of April 24.

The Buhoup Vestibule.

The illustrations show a chair car equipped with the Buhoup vestibule, built by the Barney & Smith Car Company, for the Kansas City, Pittsburgh & Gulf. We have given in former issues and especially in those of March 2, 9 and 23 of 1894 and May 3, 1895, the history of the vestibule and the principle forms in which it is now made by different companies, but the Buhoup vestibule differs from those before described in several details.

The principal difference is in the construction of the face plates, which are so arranged as to give the upper and lower buffer a longitudinal movement, but no lateral movement, while the vertical buffers have both lateral and longitudinal movement. The way that this is accomplished is clearly shown in the engravings.

The advantages of the lateral movement are that when cars are running on reverse curves and moving laterally to each other the vertical buffers remain in contact, keeping the opening between the cars always the same and avoiding the danger of the hands of any person being caught between the face plates.

During the lateral movement of the vertical buffers, which are connected with a spanner bar, the springs between them are compressed one way or the other, and, as soon as released from the action of the car, return the vertical buffers to their normal position. It is seen that the face plates are made of separate pieces and consequently damage to any one of them may be repaired without changing the entire face plate.

The usual accordion-like diaphragm back of the face plates, providing for a variation of distance between the cars, is not used, a rubber curtain attached to a spring roller taking its place. The principle was first used by Mr. J. A. Bissell in 1890. The roller is made from gas pipe and has a very stout spring on the inside, and is connected at its vertical center with the iron face plate. Any movement of the face plate is provided for by this roller in connection with the curtain, thus obtaining a smooth surface between the face plate and platform, instead of the rough accordion surface which usually has to be covered by a curtain.

The longitudinal movements of the face plate are controlled by the old and well-known method of stems running longitudinally with the car on which springs are placed, holding it in position, and the framework of the vestibule is similar to that used on any other construction.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

We have many times had occasion to note that one reason why legislatures reduce railroad rates with such easy thoughtlessness is that the railroads themselves make injudicious reductions. This was the case in the New York free-bicycle law, and the same principle has appeared in discussions published by the Interstate Commerce Commission. Another instance is the bill, which the New York Legislature has passed, requiring that mileage tickets be made good for the buyer's family or firm. The introducer of the proposition had seen such tickets issued voluntarily by the railroads, and no doubt felt sure that in urging the passage of the bill he was doing a good thing for his constituents while hurting the railroad but a very little; and, as in so many other cases, a five-minute speech from a country lawyer, more or less prejudiced against the railroads, probably convinced the legislators that they possessed a perfect knowledge of the moral and legal rights of the railroad company in the premises and were competent to give an intelligent vote on the subject. But in point of fact, this loosening of the limit on such tickets really makes them open to every one, or good for bearer, and may materially reduce a railroad's revenue, while also perpetuating a very objectionable form of ticket. Unless the railroad demands, beforehand, the photograph and the autograph of every person who has a right to use such a ticket, the ticket must be accepted from any one who may get hold of it. Who would ever think of requiring conductors to compel every woman or boy presenting John Smith's ticket to furnish satisfactory evidence that she or he belonged to the said Smith's family? It is safe to say that tickets which railroad companies voluntarily make good for families or firms are always sold at a rate which the road is entirely willing to carry any person for, whether it be a sister, a cousin or a tenth cousin. The restriction to the "family" is too vague a limit to be taken seriously; and if not so taken, its presence in a legislative enactment is an absurdity. The Governor had not signed the bill at last accounts.

The Chicago reporters have so long been in the habit of writing about the troubles or the anger of some railroad officer, or his alleged violent denunciations of some other railroad man, that they keep it up, though with diminished vigor, now that rate-troubles and crinations are becoming things of the past. The latest deliverance, which, very likely, has some foundation of fact, but which cannot possibly be based on any complaint warranting such elaborate mourning, is the following:

"WESTERN LINES KICKING."

"The Western roads are chafing over what they consider the efforts of the Joint Traffic Association to regulate all matters throughout the United States. The Joint Traffic Association has set up the claim that all parties to any joint rate sheet must submit all rates through any portion of their territory to the Board of Managers of the association before the rate sheets are issued. It further demands that the rate sheets shall bear on their face the announcement that the rates contained therein have been approved by the Board of Managers of the Joint Traffic Association. This demand

virtually means that no rate from any part of the United States to any point in the territory east of Chicago and St. Louis and north of the Ohio River may be put into effect until it has been approved by the Board of Managers of the Joint Traffic Association. Under this demand it is conceded none of the transcontinental roads can reduce the rates from San Francisco to New York without the consent of the Joint Traffic Association, even though the road making the reduction may stand all the cut and pay the Joint Traffic roads their full percentages. The Western roads are indignant at the demands of the Eastern lines.

This outrageous demand of the Eastern lines, put in other words, is that you must not raise or lower the rates over my road without my consent. How terrible! The law makes me a partner with you in the business of carrying goods over your line from A to B and over mine from B to C (if we make a through rate), and a joint tariff must be issued by you at A, showing the through rate, for which tariff I am jointly responsible; it must conform to the law. And yet for years the railroads all over the country have allowed connections to change rates and issue new tariffs in such cases without first consulting and getting the approval of every road interested; and so now the man who inspired this press dispatch claims the privilege of doing this, as a right. The wonder is that such a loose practice should have been tolerated so long. It is true that the relations have been reciprocal; that while a Chicago agent made rates to New York without consulting the Eastern road the New York agent made westbound rates without consulting the Western road; but that did not equalize matters, for the volume of traffic, the profitability of the rates and the frequency of fluctuations were quite different at the different cities. It is to be hoped that the Joint Traffic Association will stick to its point. The Interstate Commerce Commission tried to correct this irregularity some time ago, but evidently did not entirely succeed. Now is a good time to give the reform a new lift. The Commission can do more good in this direction than it can in trying to establish uniform classification, or in trying to settle quadrangular discrimination complaints which have a floating fulcrum at each angle.

Cast-Iron Railroad Bridges in England.

In 1891 a good deal of interest was excited by the failure of a cast-iron bridge on the London, Brighton & South Coast Railway at Norwood Junction, only nine miles from London Bridge station. The bridge carries the railroad over a street, and carries seven tracks. The span is 25 ft. on the square and 26½ on the skew. The longitudinal girders were each 30 ft. long, 27 in. deep, with bottom flanges 20 in. wide. The girder which failed broke into three principal pieces, one 13½ ft. long, one 1½ ft. and one 4½ ft. The fracture showed plainly the existence of an original flaw extending down through the lower part of the web and into the bottom flange, its total length being about 12 in.

When the girder gave way a passenger train was crossing at a speed of 40 to 50 miles an hour. All of the wheels of the 12 cars left the rails, but the train was stopped in 190 yards. It was equipped with the Westinghouse automatic brake, and the engineman felt a shock as he came on the bridge and applied the brake instantly. The rails held together, no car went through the bridge, and fortunately no one was killed and only half a dozen persons injured.

This accident, occurring as it did, under a fast and heavy express train, and almost in the streets of London, caused some excitement, and of course there was a prompt investigation by the Board of Trade. One result of this investigation was a circular issued to all the railroads of the United Kingdom asking for a statement of the total number of "under bridges" in which the superstructure is composed of cast iron, wrought iron, steel or timber. This circular was issued July 14, 1891. We have just received the Blue Book containing the answers of the railroad companies, and from it we can glean some interesting particulars as to the use of cast-iron bridges in England.

From a somewhat hurried and superficial examination of the reports we ascertain that there are 2,828 cast-iron bridges in use on the railroads of England and Wales, and there are 5,236 wrought iron bridges, 1,391 wooden bridges and 121 steel bridges. We have not counted those reported for Scotland and Ireland. Masonry bridges, of which there are a great many in England, are not included in this report.

These are large figures, and to the hasty reader would indicate that England is a well-watered land. But of these 9,576 bridges (more or less; we do not profess to have counted them carefully), a great many are over highways and many others are cattle guards, or, as they are called in the report, cattle creeps or sheep creeps. What percentage are crossings of highways or cattle guards we have no means of judging, but the spans are very short. The timber bridges run

from 7 ft. to 12 or 15 ft., very seldom more, and are simple square timbers. We find mention of one wooden truss 37 ft. long.

But the most peculiar fact to an engineer or a railroad officer on this side of the water is the great use of cast iron. In this country it would be hard to find a cast-iron bridge in railroad use. There are still a few trussed girders with cast-iron compression members, but these have nearly disappeared and we do not do not remember an example of a solid cast-iron girder; but this latter is the chief use of cast iron in English railroad bridges. In the returns they are described as flat girders or I-shaped girders. Naturally, the spans are very short; the longest span with solid cast-iron girders that we find is 48 feet. In Ireland we find a 46-ft. span with a cast-iron girder 52 ft. long, in one casting. There are arches from 44 feet up to 157, but these are very few. These cast-iron bridges run from 10 feet up to 30, a few less and a few more. On the Great Eastern, which reports in great detail, we find the following spans of cast-iron girders: Over 30 ft., 46 bridges; between 20 ft. and 30 ft., 76; between 10 ft. and 20 ft., 40; under 10 ft., 4; but on this road the percentage of cast-iron spans over 30 ft. seems to be greater than on any of the other great lines.

Many of these cast-iron bridges must be very old and must have been designed for considerably lighter engines than are now generally used. The report of the Board of Trade Inspector on the London, Brighton & South Coast accident, says that the girder which failed there had been in use since 1860; that is, more than 30 years. He says also that this failure was probably due to the flaw, but that the girder was too light for the work to which it was subjected. And yet we hear of very few bridge accidents in England. In fact, considering the great number of cast-iron girders and considering that so many of them must have been designed when the average locomotive was lighter than it is to-day, and when speeds were lower, it is astonishing that accidents of this class are so infrequent. We must assume good castings to begin with and good inspection by the officers of the railroads. At the time of the Brighton accident there was considerable published criticism of the use of cast iron for this purpose, and nobody will deny now that it is a very undesirable material for railroad bridges. But in spite of all that the English bridges very seldom fail.

The Results of a Broken Rail.

Last November an accident occurred at St. Neots station on the Great Northern Railway (England), which attracted a good deal of attention, and which has been the subject of a careful investigation by the inspector of the British Board of Trade. The report of the inspector, Major Marindin, dated Dec. 24, has just been received in a parliamentary blue book. We return to the accident now in order to call attention to the cause, which was a peculiar rail fracture. First, however, it is well to repeat briefly the circumstances of the accident.

The train which was wrecked was running northward at a speed of 60 miles an hour, or perhaps more. The train proper consisted of nine vehicles, weighing 329,056 lbs. The tender (as weighed after the accident) weighed 93,296 lbs., the engine weighed 110,992 lbs., making the total weight of the train 533,344 lbs. This was hauled by a "single" driver-engine; the drivers according to the diagram were 8 ft. in diameter, but by actual measurement they were 8 ft. 2 in. diameter. There were a four-wheeled bogie truck leading and a pair of trailing wheels 4 ft. 8 in. in diameter trailing.

The drivers carried a very heavy load. According to the diagram furnished by the railroad company, this load is 20 long tons. As weighed after the accident, the drivers carried 19 tons and 4 cwt.; this is 21,500 lbs. on each wheel. There are a good many passenger engines running in this country which carry about as heavy a load. For example, looking over the records of new locomotives of the last two or three years, we find the following heavy express engines:

	No. of drivers.	Load per driver, lbs.
New York Central, No. 999.....	4	21,000
New York Central (Empire), class "I".....	4	20,354
Central of New Jersey compounds.....	4	20,350
Pennsylvania, class P.....	4	21,850
C. & B. & Q. "Columbia".....	4	21,550
Delaware & Hudson.....	4	21,000
C. & C. & St. L.....	4	20,000
Lehigh Valley.....	4	22,500
Philadelphia & Reading "single".....	2	24,000

An engine carrying 20,000 lbs. or more on a driver and run at 60 miles an hour or upward demands good track. In the Great Northern case, a rail broke under the driving wheel and the derailment followed. The train was fitted with the automatic vacuum brake; the engine and the front part of the train ran over 519 yards before it was stopped; the brake was

applied automatically, and the inspector feels justified in saying that it worked well.

The first rail to break, the more southerly of the two broken rails, was broken into 17 pieces, no one of which was over 22 in. long. The rail next north of it broke into four pieces. These rails were laid in 1873; and in 1886, after 13 years' service, they were taken up when a portion of the line was relaid. The rails which were taken out of track were stacked in St. Neots yard and some time later the two which broke were put in the track. The inspector does not know precisely when they were relaid; it may have been in the spring of 1895 when some alterations were made at the station, or it may have been at some date, not ascertained, between 1886 and 1895.

The broken rails were of the usual English "bull-head" section, and weighed originally 80 lbs. to the yard. This weight had been reduced by wear to 70 lbs. per yard in the case of the southernmost rail (the first one to break), and to 72.3 lbs. per yard in the case of the other rail. The extreme wear of the top of the rail amounted to as much as five-sixteenths of an inch, and on the bottom, where the rail rests on the chair, the extreme wear was found to be one-eighth of an inch.

The inspector is of opinion that the Great Northern Railway, running such heavy and fast engines, should increase its standard weight, which is now 84 lbs., to at least 90 lbs. per yard, and should replace with new rails all the old 80-lb. rails on the main line. It is a fact that since the St. Neots accident the company has been putting in many new rails; we have not learned, however, what weight has been adopted.

The important thing to ascertain is, why these rails broke. The inspector had chemical analyses and physical tests made of the pieces of the broken rails by five different experts, and two of these experts made careful microscopical examinations of the broken pieces. The reports of these experts are given in the blue book only in a very condensed shape. After careful consideration of the analyses of the tests, of the opinions of the experts and of the microscopical information, the inspector has reached the conclusion that the first fracture of the rail took place at a minute induced flaw which did not exist when the rail was made and which could not have been detected by the naked eye. The microscopical examination showed the existence, across the rail, of a number of such minute flaws. These began at the top and were gradually extending down into the rail. "Although it is not possible to say which was the first fracture, it is not improbable that it was one almost immediately over a chair where the rail shows unmistakable signs of having broken from the surface downward." The appearance of some of the fractures is such as might have been expected if the rail had been subject to a heavy blow; but there was no sign of obstruction having been on the rail and the driver felt nothing unusual as he would have done if an obstruction had been run over. The inspector is therefore pretty confident that the first breaking was due to the weakening of the rail section from wear, and to the presence of the numerous minute flaws. The subsequent fractures might easily have been caused by the blows of the wheels after the first breaking.

The chemical analyses by four experts show considerable variations in samples taken from the same rails. The carbon runs from 0.437 up to 0.54; the silicon runs from 0.11 up to 0.13; the sulphur runs from 0.078 up to 0.106; the phosphorus runs from 0.07 up to 0.088; the manganese runs from 0.35 up to 0.493. The rail which has carbon 0.54 has silicon 0.11; sulphur, 0.09; phosphorus, 0.087. The rail of lowest carbon, namely, 0.437, has silicon 0.117, and phosphorus 0.07. It will be observed that these rails are not excessively high in carbon, as judged by what may be considered the best American practice; nor are the other foreign elements excessive, although the phosphorus is somewhat higher than would be specified now, by careful engineers, for high carbon rails.

Somewhat curious results are shown from the pulling tests, some facts from which are tabulated below for convenient reference. In these will be seen a pretty wide variation in the results got by the different investigators, but there is a general agreement that the bottom of the rail gave much better results than the top. This is especially apparent in the ultimate breaking stress, in the reduction of area and in the elongation.

A pretty careful study of rail metal made recently in Austria brings out facts of considerable interest taken in connection with the examinations of the broken rails of the Great Northern. Mr. Von Dormus, the reporter of these Austrian experiments, says that as the rails wore down they began to break crosswise, a rail frequently breaking into several pieces. The observation of this fact led to a careful study. Test bars were taken

from the top, the web and the foot of the rail. These bars showed that the metal from the top of the rail has "less ultimate strength but greater elongation; from the center of the head of the rail it has greater strength and less elongation; from the web it has greater strength and greater elongation; from the base, less strength and greater elongation." From his observation it appears that the number of broken rails is larger when they are first put down, then decreases and remains constant for some years, and then increases again, often rapidly. The greater number in the beginning, he explains by supposing that weak rails are thus rapidly eliminated; then as abrasion goes on the more brittle metal toward the inside of the rail head comes near the surface, the quantity of the tougher metal from the outside becomes less, and the number of breaks increases, the rails then beginning to break up into short pieces. The rails investigated by Regierungsrath Ast and reported on by Mr. Von Dormus do not cover a sufficient range of mill practice, of material or of experience to establish the general laws which these gentlemen attempt to formulate, but their agreement with the results of other investigators adds probability to them, and their studies are worth careful attention. For that reason we print on another page a translation of and abridgement of the report.

Pulling Tests of Great Northern (England) Rails.

	Ki-kaldy.	Andrews.	Heath.
Elastic Limit; Head South Rail.....	47,800	45,564	46,771
Elastic Limit; Bottom South Rail.....	49,500	48,720	49,840
Ultimate Stress; Head South Rail.....	88,840	94,416	82,169
Ultimate Stress; Bottom South Rail.....	94,110	94,416	94,730
Ultimate Stress; Top North Rail.....	32,670		38,112
Ultimate Stress; Bottom North Rail.....	100,000		94,416
Contraction of Area, Per Cent.; Head South Rail.....	5.0	33.9	4.55
Contraction of Area, Per Cent.; Bottom So. Rail.....	30.6	31.8	20.59
Contraction of Area, Per Cent.; Bottom No. Rail.....	10.1		27.93
Contraction of Area, Per Cent.; No'n Rail, Head.....			31.60
Elongation, Per Cent.; Head South Rail.....	4.37	21.7	7.43
Elongation, Per Cent.; Bottom South Rail.....	18.4	20.3	15.4
Elongation, Per Cent.; Bottom North Rail.....	9.9		18.0
Elongation, Per Cent.; Top North Rail.....	Nil.		11.0

* In these cases it is not stated from which rail the specimens were taken. We assume that it was the Northern, as the others in Mr. Heath's tests are from the "broken rail."

The St. Louis & San Francisco Reorganization.

A plan for the reorganization of the St. Louis & San Francisco Railroad was issued last week and is of considerable importance, because it provides for an independent existence for this company in the future. For the last six years this road has been part of the Atchison system, the Atchison, Topeka & Santa Fe having control of the whole capital stock of the smaller road and having acquired a large block of its consolidated mortgage. More than five and a half millions of this mortgage was pledged by the Atchison at various times during the six years of its ownership as collateral security for its votes. In the process of reorganization of the Atchison system, and since its sale under foreclosure in December, the Atchison reorganization committee has taken up these notes, and has for some time been trying to come to a satisfactory agreement with the holders of the rest of the St. Louis & San Francisco consolidated mortgage for a reconstruction of the latter road on an independent basis. These negotiations came to nothing, because the non-Atchison holders had fears that the future control of the company would be still in the hands of the Atchison managers. The result has been that the present reorganization committee for the St. Louis & San Francisco bondholders had made arrangements to buy in the whole block of the consolidated mortgage now held by the Atchison committee at the price of \$35 and thus to clear up the situation entirely.

This main obstacle once overcome, the provisions of the new plan seem satisfactory and feasible, although they bear heavily on the bondholders, who, as a class, have fared rather better in recent railroad reorganizations than in the present case. In the meantime, on the last day of April, at St. Louis, Judge Caldwell, of the United States Circuit Court, granted a decree of foreclosure setting the date for the sale on June 27. As the committee have pledged themselves to hasten the foreclosure proceedings it may fairly be expected that the whole matter will be accomplished and the company started on an independent basis by midsummer.

The details of the plan may be summarized as follows: In the first place there are to be four classes of new securities. (1) \$50,000,000 consolidated mortgage 4s; (2) \$5,000,000 first preferred stock, non cumulative, paying four per cent. dividend; (3) \$16,000,000 second preferred stock, also non-cumulative, and paying four per cent.;

(4) \$29,000,000 common stock. These securities are to be applied in the following ways:

New Bonds.	To take up undisturbed prior liens ..	\$39,072,000
	To part of subscription of holders of the present consolidated mortgage ..	5,500,000
	For general reorganization purposes..	5,428,000
		\$50,000,000
First Preferred Stock	In repayment of assessment on the consolidated mortgage.....	\$1,149,974
	For subscription by bondholders.....	3,850,026
		\$5,000,000
Second Preferred Stock	For consolidated mortgage bonds....	\$3,214,100
	For subscription by bondholders.....	5,500,000
	For general reorganization purposes..	2,285,900
		\$11,000,000
Common Stock.	For consolidated bonds	\$14,785,380
	For subscription by bondholders.....	9,900,000
	For general reorganization purposes..	4,314,620
		\$29,000,000

On this new capitalization the fixed charges will amount to only \$1,904,330 as against \$2,531,074 at present. This gives a good margin for earnings on the contingent securities if the road were up to the average of its earning power in past years. A view of the record for the last five years proves this:

	Gross Earn.	Oper. Exp.	Net Earn.
1891.....	\$6,748,508.08	\$3,810,858.56	\$2,937,649.52
1892.....	7,053,228.20	4,013,184.03	3,040,044.17
1893.....	7,542,657.73	4,153,151.48	3,389,506.25
1894.....	6,178,735.85	3,898,908.60	2,279,827.25
1895.....	6,081,494.41	3,542,132.83	2,539,361.58

The average figures for the net earnings for the last nine years (operating expenses and taxes deducted) is \$2,654,810, giving a surplus under the new system of \$660,480, which allows for a four per cent. dividend on the first preferred stock, and leaves a balance of \$460,480 for the two remaining classes of stock.

The condition of the property financially, and even physically, is very bad. Nothing shows this more strikingly than the following estimate of the cash requirements on July 1, 1896:

Arrears of interest, etc.....	\$2,231,500
Car trusts, etc.....	1,340,000
Receiver's certificates.....	620,000
For purchase of the consols held by Atchison Committee.....	2,000,000
Expenses of reorganization.....	650,000

Total cash requirement..... \$6,841,500

In view of this immediate need of such a large sum, the assessments on the consolidated bondholders are extraordinarily heavy, amounting to 10 per cent. Besides this a syndicate has been formed to underwrite the subscriptions and the payments of assessments of the bondholders, and at the same time to advance \$1,000,000 immediately and without awaiting further developments. The need of money to improve the physical condition of the road is evidently pressing. Sums spent on improvements have fallen from their highest figure, \$198,039 in 1891, to \$46,049 in 1895. Consequently the present plan makes provision for this purpose by receiving enough of the new bonds to ensure the possibility of a sufficient yearly expenditure not to exceed \$300,000.

To make it certain that the property will be managed consistently in the interests of the bondholders the usual provision for a five years' voting trust is made part of the new plan. The great misfortune of the road has been its past management as a subordinate part of the Atchison system, subservient to its needs, and exploited for its purposes. From six years of this sort of control the St. Louis & San Francisco emerges in a sorry condition, and it is only a severe reorganization like this proposed by the present plan which can ever put it on its feet again.

Annual Reports.

Union Pacific.—The annual report for the year to December 31 contains full statistics of the year's operations, but it is issued without any comment by the Receivers officers on the company's affairs. However, in view of the peculiar position of the property, and the unsettled and complicated questions which affect its future operations, any explanation of the year's business would not be of much use as a guide to the future of the road.

The impending disruption of the system, through the separate reorganization of several of its most important divisions, will involve a loss of a considerable mileage, about a third of the present total. The lines which are to be independently reorganized are the Oregon Short Line and Utah Northern, 1,428 miles; the St. Joseph & Grand Island, 251 miles; the Kansas City & Omaha, 114 miles, and the Central Branch, Union Pacific, 388 miles; comprising altogether 2,261 miles of the 5,328 miles of road covered by this report.

For this reason many of the figures are of minor interest, and we give only the general results of the whole "system."

	1895.	1894.	Inc. or Dec.
Gross earn	\$22,554,738	\$23,354,712	D. \$79,974
Oper. exp.....	14,192,597	16,878,786	D. 2,686,189
Net earn.....	\$8,362,141	\$6,475,926	I. \$1,886,215
Taxes.....	1,181,924	795,504	I. 386,420
Other income.....	1,730,886	770,116	I. 960,770
Total income.....	\$8,917,102	\$6,450,538	I. \$2,466,564
Fixed charges.....	10,431,422	10,407,858	I. 23,564
Balance (deficit).....	\$1,514,320	\$3,957,320	D. \$2,443,000

The conversion of a decrease of \$800,000 in gross earnings, \$1,500,000 in net earnings, was accomplished by heavy reductions in all departments, which obviously must be made up in other years. In the one item of rail renewals \$497,000 was saved; other maintenance of way expenses decreased \$793,000; equipment maintenance cost \$63,000 less than in 1894 and \$750,000 was saved in transportation expenses.

But the chief interest in the report is in the showing of the Union Pacific Railway Co. proper, the only part

of the system in which the Government is concerned. Here the comparisons are more favorable than for all the lines, but the good showing is in net, and is partly due to economies in equipment and maintenance, which probably cannot be continued without detriment to the property. We append the summary of operations for the year:

Earnings:			
	1895.	1894.	Inc. or dec.
Freight, commercial.....	\$9,448,651	\$9,710,953	D. \$262,302
government.....	121,209	56,594	I. 64,615
company.....	290,914	446,103	D. 155,189
Passenger, commercial.....	2,409,248	2,358,441	I. 50,806
government.....	56,465	78,173	D. 21,708
Mail Car service, etc.....	2,020,371	2,127,513	D. 107,142
Total earnings.....	\$14,336,291	\$14,817,807	D. \$481,515
Oper. expenses:			
Maintenance of way and structures.....	\$1,333,531	\$1,583,057	D. \$249,526
Renewal of rails.....	29,833	374,523	D. 344,691
Maintenance of equipment.....	2,062,337	2,512,422	D. 450,085
Conducting transportation.....	4,877,819	5,217,573	D. 339,754
General expenses.....	533,801	498,054	I. 35,746
Taxes.....	596,812	317,098	I. 279,713
Total.....	\$9,434,133	\$10,502,728	I. \$1,068,595
Surplus earnings.....	4,902,157	4,315,077	I. 587,080
P. c. oper. exp. to earn.....	65.8	70.9	D. 5.07

This table shows a gain in net earnings of \$587,080. But the final results, after deducting fixed charges, etc., make the showing even better. The miscellaneous additional income of the company from land sales, investments, interest on sinking funds, etc., added \$1,904,669 to the net earnings. The final results appear from this table:

Total net income.....	\$6,804,826
Disbursements—Interest on bonds.....	\$1,551,281
Earnings due United States.....	1,277,116
Sinking fund.....	693,750
Miscellaneous.....	1,652,658
Total.....	7,574,788
Leaving a deficit of.....	\$767,962

This deficit stands against a similar deficit of \$1,862,793 for the year 1894, and therefore represents a great gain; but it is a long step back to earlier conditions when even in 1893 there was a final surplus of \$231,267.

The reorganization plan of the Union Pacific has now received the assent of 90 per cent. of all outstanding stock and over 76 per cent. of all outstanding bonds. That plan provides for an issue of \$100,000,000 four per cent. bonds, which would call for \$4,000,000 a year to meet interest charges, if the entire amount is issued. But the plan provides for setting apart \$35,000,000 of these bonds for payment of the United States debt. It will be seen that the net earnings much more than meet this interest charge.

If the relations of the company with the government could be settled in some satisfactory manner the reorganization could be put through and the company re-established. But the whole question of the government debt hangs fire. The committee of the House of Representatives has, indeed, reported a revised bill, providing for the refunding of the debt at two per cent. The chances of such a proposition being enacted into law at this session of Congress seems very slight. On Jan. 1, 1897, this debt remaining will be (after deducting sinking funds) \$53,715,408 for the Union Pacific and the Kansas Pacific, and \$57,681,514 for the Central Pacific and Western Pacific.

Lake Erie & Western.—The annual report of the Lake Erie & Western Railroad Company for the year ending Dec. 31, 1895, was published last week. The main results of operation are as below.

	1895.	1894.	1893.
Earnings.....	\$3,519,104	\$3,345,404	\$3,512,620
Expenses.....	2,150,430	2,093,501	2,254,241
Net earnings.....	\$1,368,675	\$1,251,902	\$1,258,380
P. c. of working exp.....	51.45	55.77	58.33

The payments for interest, taxes and rentals for the year 1895 aggregated \$701,786; dividends of five per cent. on preferred stock amounted to \$592,000, and the balance carried to surplus was \$309,175. The increase in freight tonnage was 1.86 per cent. and the gross earnings from freight increased 6.19 per cent. The increase in the ton-mile rate was 0.03 cents, the rate last year having been 0.661. The passenger traffic showed an increase of 6.42 per cent. in numbers carried, and of 7.35 per cent. in earnings. The rate per mile decreased 0.01 cent. but the average haul increased.

When the Pittsburgh, Akron & Western (now the Northern Ohio) was leased, an issue of \$2,500,000 in bonds was made, from which \$1,000,000 in cash was set aside for the betterment and equipment of that line. These improvements are in progress and moreover it is the purpose to extend the line from Akron to Newcastle, Pa.

The surplus now accumulated would seem to justify the payment of the full rate of dividend to which the preferred stock is entitled, but the company must make heavy expenditures in equipping with air-brake and automatic couplers to comply with the Interstate Commerce law. The total cost of the equipment of 6,000 cars and 120 engines will be \$600,000, part of which will be provided by the earnings, but the greater part by the sale of the second mortgage bonds in the treasury. It is estimated that the air-brake equipment costs \$70 per car and \$500 an engine, while the couplers cost \$20 per car.

The Appellate Division of the Supreme Court of New York, First department, has sustained the Railroad Commissioners in their refusal to grant a certificate,

under section 59 of the railroad law, to the Empire City Traction Company, which applied for the usual certificate for the construction of a street railroad across the city of New York near the north end of Central Park. This case arose in consequence of a confusion of provisions in the railroad laws of the state. Section 59, as it stood in 1893, prohibits railroad corporations from exercising the powers conferred by law until the Board of Railroad Commissioners certify that public convenience and necessity require the construction of the proposed road. Then, in 1895, this law was made to apply to street railroads, which it did not before. But by another section of the law a street railroad company in New York City cannot get its franchise from the city, except after a public auction, at which, competing with other bidders, it has agreed to give the city a percentage of the gross receipts of the proposed railroad. The Commissioners refused the application of the Empire City company for the reason that if the desired certificate should be granted, the Board would have to give a certificate to any company which desired to bid for a franchise, and thus might have to give certificates to a number of companies over the same route. What the law ought to say is that a railroad company "shall not begin to build" instead of "shall not exercise any of its powers." This is the common sense view, and a construction of the law in accordance with it is what the court now approves. The intention of the law, says the court, was to prevent unnecessary parallel roads and to prevent holders of franchises from obstructing a competitor who might be more willing or ready to build a necessary road. If the railroad commissioners were to issue divers certificates over the same route they would frustrate one of the objects of the law, and such a construction should not be put upon the act. It is therefore held that there is no incapacity upon the part of the applicant to bid at the sale of the desired franchise before it receives the Commissioner's certificate. If there is a risk that the conflicting clauses of the law may make trouble the remedy is to be found in additional legislation.

"Government by Brewery," is the title of an article in the *Arena* for April, by President George A. Gates, of Iowa College, in which he prints a copy of a letter from the General Superintendent of a railroad in Wisconsin, to an agent of the road at a small town in that state (not named), directing the agent to see a certain employee and explain to him that the railroad company "wishes him to cease his activity" against the saloons in the town where he lives. It appears that the employee was a member of the City Council, and voted in favor of an ordinance prohibiting screens in the windows of saloons. He did not circulate the petition on which the ordinance was based, but he voted for it, and the Milwaukee brewing interests sent an agent to the town and got up a petition requesting the removal of this employee. The Superintendent in his letter said that he did not desire to interfere with the private opinions of employees, but that this one should be made to understand that he should not be "specially active and obnoxious." President Gates says: "How generous; an employee may hold any opinion he chooses, but any expression of such opinion by word or act brings instant decapitation! Why, I would almost be willing to have the devil a member of my household under those conditions." President Gates also publishes an extract from the *Wine and Spirit Gazette*, of New York, telling how a certain railroad company "is rigorously enforcing its rule forbidding its employees to indulge in wine, liquor or beer. . . . A young engineer who protested his innocence was confronted with a photograph showing him in the act of drinking a glass of beer. The kodak had done the business, and he was discharged. . . . A company may properly demand sobriety of its men on duty, but it certainly has no right to interfere with them at other times." The article goes on to say that this railroad company issues editorial passes to prohibition papers in exchange for advertising space, and a copy of the article was subsequently sent to an official of the road named, with a threat to republish the same (in another liquor dealers' paper) unless advertisements and passes were forthcoming. The railroad officer ignored the threat.

The plan of making settlements for through billing in the auditors' offices instead of by junction settlements, which was adopted by the Vanderbilt lines about four months ago, has been given up. Auditors' settlements could not be made to work smoothly without the co-operation of the New England roads, and those roads, which seem to have joined the movement in a half hearted manner, recently gave notice that they would withdraw. This caused others to weaken, and so the plan has had to be dropped entirely. It would seem that some of the roads have failed to examine the new plan with sufficient care to appreciate its advantages.

NEW PUBLICATIONS.

The United States Public Works. By Capt. W. M. Black, Corps of Engineers, U. S. A., M. Am. Soc. C. E. Pages 276, 7 in. x 9 in., with 38 plates of photogravures and working drawings, and 19 figures in the text; index. New York: John Wiley & Sons. Price, \$5. We cannot better give an idea of the contents of this book than by copying the table of contents in full. "The United States Public Works, containing a summary of the methods of construction and character of materials and plant used in the Public Works under the charge of the War and Treasury Departments, and

of the Commissioners of the District of Columbia, including works of river and harbor improvement, buildings at posts of the United States army, lighthouses, public buildings, life-saving stations and works of municipal engineering of Washington, D. C.; also of the laws, regulations and forms prescribed for the conduct of such works, and a directory of the United States agents in charge of these works and of contractors for them, also of manufacturers of and dealers in machinery, materials and miscellaneous supplies used in the construction of the works. Published as a book of reference for all persons interested in the public works and for engineers and contractors in general." That title page is a pretty comprehensive book review in itself. Captain Black tells us further, in his introduction, that it is the design of his book to show the prescribed business methods of the departments which control the government works and to describe the nature of the works, plant and material. The subject includes the methods and work of the Corps of Engineers and Quartermaster's Department; of the Lighthouse Establishment; the Life-Saving Service, and the Supervising Architect's Office, and of the officers charged with the public works in Washington.

The first chapter gives the general laws and regulations; other chapters describe the departments and give their special laws and regulations and their official forms. Typical works are described and illustrated by photographs and detailed drawings, methods, plant, materials and organization of working parties are described, and tables of cost are given. Finally, while the book does not treat of engineering principles, it is hoped that the engineering profession will find something of interest and value in the descriptions.

The division of "War Department Public Works" fills 76 pages. Here are described actual works of dredging and rock excavation; shore protection, jetties, dykes and breakwaters; river regulation works, locks and dams. Many important works of the Engineer Bureau are here described, with statements of costs of labor and material and numerous valuable engravings. This division alone entitles the book to a place in the library of the engineer.

In the division of "Treasury Department Work" the first subject taken up is the Lighthouse Establishment. The organization and methods are described and then twenty-one pages are given to specific descriptions of lighthouses and beacons. The engravings of these are interesting, but of minor value as they lack detail. The organization and methods of the Office of the Supervising Architect are described at considerable length and a short account of the work of the life-saving service follows.

The way of contracting for and carrying on the municipal works of the District of Columbia is described in 16 pages.

In a chapter of 40 pages are the forms of proposals, contracts and bonds in the various departments. Directories are given of names and addresses of officers in charge of the various districts and works including Post Quartermasters. These must be of only temporary value as the officers are changed more or less frequently. Finally, there are directories of contractors, compiled from the lists of bidders, and of makers of and dealers in machinery and supplies. The book has an elaborate index.

TRADE CATALOGUES.

Velocipede Cars and Hand-Cars.—The Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

This company has just issued its catalogue for 1896. The new features to which attention is called are a new "safety"; a ball-bearing, steel velocipede for the use of one person; a gas motor inspection car with 2 or 10 H. P. motors, and a malleable-center, steel-tired, hand-car wheel. The new "safety" weighs 55 lbs. It is made with a bicycle, diamond frame, and propelled precisely like a bicycle; the third wheel is mounted on a swinging arm for convenience in carrying. The ball-bearing steel velocipede weighs 90 lbs. The frame is made of channel steel, and in this case also the third wheel is mounted on a swinging arm. This is driven by sprocket wheels and chain like the ordinary bicycle. The malleable-center wheel weighs 40 lbs. It is composed of two pieces and has no bolts or rivets; the hub, spokes and rim, of malleable iron, are cast in one piece. The tire is of open-hearth steel, spun into shape, and shrunk on the center. This company also builds steam inspection cars of 2,000 to 3,000 lbs. weight, built to carry several people. The 3,000-lb. car has a capacity of from 12 to 15 passengers and a speed of 25 miles an hour.

Bolts, Nuts, etc.—The Port Chester (N. Y.) Bolt & Nut Co. has issued its catalogue for 1896, showing many varieties and sizes of bolts and washers. The company manufactures a large assortment of these, there being over 70 cuts to show the different kinds of nuts and bolts, besides cuts of other devices. The company has enlarged its work and now makes special iron and steel forgings from sketches or patterns and claims to give unusual exactness in this line of work. The company also does iron work for buildings, bridges, docks and other structures, including bridle irons, truss rods, wall anchors, hinges, etc. A specialty is made of iron work and forgings for ships and yachts, including mushroom and folding anchors, and to keep up with the times the company now makes a large assortment of bicycle nuts. In the catalogue are convenient tables of weights of iron plates and round and square iron rods.

Southern Pine—Mechanical and Physical Properties.*

The following results of the timber investigations carried on by the Division of Forestry in the laboratory at St. Louis under Prof. J. B. Johnson, and in the laboratory at Washington, by Mr. Filibert Roth, are published in condensed form in advance of a fuller account in order to make the information more speedily available. The data contained in this circular are condensed from not less than 20,000 tests, and a similarly large number of measurements and weighings, fuller details of which will appear in a special bulletin.

The chief points of superiority of the data obtained in these investigations lie in (1) correct identification of the material, it being collected by a competent botanist in the woods; (2) selection of representative trees with record of their age, development, place where grown, etc.; (3) determination of moisture conditions of the test pieces, the most influential factor on strength; (4) large number of trees and of test pieces from each tree; (5) employment of large and small sized test material from the same trees; (6) uniformity of method for an unusually large number of tests.

The Material under Consideration.—The importance of reliable information regarding the pines of the South is evident from the fact that they furnish the bulk of the hard pine material used for constructive purposes with an annual cut hardly short of 7,000,000,000 ft., B.M., which, with the decline of the soft pine supplies in the North, is bound to increase rapidly.

Although covering the largest area of coniferous growth in the country (about 230,000 sq. m.), proper economies in their use are nevertheless most needful, since much of this area is already severely culled and the cut per acre has never been very large. Hence the demonstration (a result of the investigations in this division) that bled pine is as strong and useful as unbled, and the assurance that longleaf pine is in the average 25 per cent. stronger than it is often supposed to be and, therefore, can be used in smaller sizes than customary at present, must be welcome as permitting a saving in forest resources which may readily be estimated at from eight to ten million dollars, annually, due to this information.

The pines under consideration are:

(1) The longleaf pine (*Pinus palustris*) also known as Georgia, or yellow, pine and in England as "pitch pine," and by a number of other names, is to be found in a belt of 100 to 150 miles in width along the Atlantic and Gulf coasts from North Carolina to Texas, furnishing over 50 per cent. of the pine timber cut in the South—the timber par excellence for heavy construction, but also useful for flooring and in other directions, where strength and wearing qualities are required.

(2) The Cuban pine (*Pinus heterophylla*), found especially in the southern portions of the longleaf pine belt, known to woodsmen commonly as "slash pine" but not distinguished in the lumber market. It is usually mixed in with longleaf, which it closely resembles although it is wider (coarse grained), and to which it is equal if not superior in weight and strength.

(3) The shortleaf pine (*Pinus echinata*), also known besides many other names as yellow pine, and as North Carolina pine, but growing through all the Southern States generally north of the longleaf pine region; much softer and with much more sapwood than the former two, useful mainly for small dimensions and as finishing wood being about 20 per cent. weaker than the longleaf pine.

(4) The loblolly, or oldfield pine (*Pinus taeda*), of similar although more southern range than the shortleaf, also known as Virginia pine, much used locally and in Washington and Baltimore, destined to find more extensive application. At present largely cut together with shortleaf and sold with it as "yellow pine," or North Carolina pine, without distinction, although sometimes far superior, approaching longleaf pine in strength and general qualities.

Mechanical Properties.—In general the wood of all these pines is heavy for pine (31 to 40 lbs. per cubic foot, when dry) soft to moderately hard (hard for pine) requiring about 1,000 lbs. per sq. inch to indent one-twentieth inch; stiff, the modulus of elasticity being from 1,500,000 upward; strong, requiring from 7,000 lbs. per square inch and upward to break in bending and over 5,000 lbs. in compression when yard-dry. The values given in this circular are averages based on a large number of tests from which only defective pieces are excluded. In all cases where the contrary is not stated the weight of the wood refers to kiln dried material and the strength to wood containing 15 per cent. moisture, which may be conceived as just on the border of air-dried condition. The first table gives fairly well the range of strength of commercial timber.

AVERAGE STRENGTH OF SOUTHERN PINE.

Air-dry material (about 15 per cent. moisture).

Name.	Compression strength.			Bending strength.			Tensile strength.	Shearing strength.
	Average of all valid tests.	Average for the weak end one-tenth of all the tests.	Across grain. Three per cent. indentation.	Average of all valid tests.	Average for the weak end one-tenth of all the tests.	At elastic limit.		
	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.
Cuban pine....	7,350	6,500	1,050	11,500	8,750	9,450	14,300	830
Longleaf pine.	6,850	5,650	1,060	10,900	8,800	8,560	15,200	706
Loblolly pine.	6,300	5,350	990	10,100	8,100	8,150	14,100	690
Shortleaf pine	5,900	4,800	940	9,230	7,000	7,200	13,100	688

Influence of Locality.—In both the Cuban and longleaf pine the locality where grown appears to have but little influence on weight or strength, and there is no reason to believe that the longleaf pine from one state is better than that from any other, since such variations as are claimed can be found on any 40-acre lot of timber in any state. But with loblolly and still more with shortleaf this seems not to be the case. Being widely distributed over many localities different in soil and climate, the growth of the shortleaf pine seems materially influenced by location. The wood from the southern coast and gulf region and even Arkansas is generally heavier than the wood from localities farther north. Very light and fine-grained wood is seldom met near the southern limit of the range, while it is almost the rule in Missouri, where forms resembling the Norway pine are by no means rare. The loblolly, occupying both wet and dry soils, varies accordingly.

Influence of Moisture.—This influence is among the most important, hence all tests have been made with due regard to moisture contents. Seasoned wood is stronger than green and moist wood the difference between green and seasoned wood may amount to 50 and even 100 per cent. The influence of seasoning consists in (1) bringing by means of shrinkage about 10 per cent. more fibers into the same square inch of cross-section than are contained in the wet wood; (2) shrinking the cell-wall itself by about 50 per cent. of its cross-section and thus hardening it, just as a cow skin becomes thinner and harder by drying.

In the following table this is illustrated; the values presented in these tables and diagrams are based on large numbers of tests and are fairly safe for ordinary use. They still require further revision, since the relations to density, etc., have had to be neglected in this study.

INFLUENCE OF MOISTURE ON STRENGTH.

Average of all valid tests.

	Per cent. of moisture.	Cuban.	Long leaf.	Loblolly.	Shortleaf.
Bending strength..	33 per cent.*	8,450	7,660	7,370	6,970
	20 "	10,050	8,970	8,650	8,170
	15 "	11,950	10,900	10,100	9,230
	10 "	15,300	14,000	12,400	11,000
Crushing endwise..	33 "	5,000	4,450	4,170	4,160
	20 "	6,000	4,450	5,350	5,100
	15 "	7,500	6,350	6,400	5,900
	10 "	9,200	9,200	8,650	7,100

* 33 per cent. green, 20 per cent. half dry, 15 per cent. yard dry, 10 per cent. room dry.

It will be observed that the strength increases by about 50 per cent. in ordinary good yard seasoning, and that it can be increased about 30 per cent. more by complete seasoning in kiln or house. Large timbers require several years before even the yard season condition is attained, but 2-in. and lighter material is generally not used with more than 15 per cent. moisture.

Effect of Kiln Drying.—Although kiln-drying has become quite universal, opinions are still divided as to its effects upon the strength of the material and other qualities. Many objections and claims as to physical and chemical changes produced by the treatment remain unsubstantiated. The method most widely used and most severely criticised is that of the "blower" kiln, where hot air (180 deg. F.) is forced into the drying room by means of powerful fans. Beside the many, in part, unreasonable and contradictory claims about closing or opening of poles, chemical or physical influence on the sap and its contents, albumen, gum, resin, sugar, etc., substances whose very existence in many cases is problematical or doubtful, the general claims of increased checking and warping, "casehardening," "honeycombing," etc., as well as reduction of strength, are still prevalent even among the very manufacturers themselves. The manner and progress of the kiln-drying may render this otherwise useful method of seasoning injurious. Rapid drying of the heavier hardwoods of complicated structure, especially in large sizes and from the green state, is apt to produce inordinate checking and thus weakening of the material. For Southern pine, however, it is entirely practicable to carry on the process without any injury, as is evidenced by the following experiment, in which wood of Cuban pine in small dimensions (4 by 4) was seasoned in warm air (about 100 deg. F.) and parts of the same scantling were dried at temperatures varying from 150 deg. at the entrance end to 190 F. at the exit.

	Bending strength.		Compression strength.
	Absolute.	At elastic limit.	
	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.
Mean of material not kiln-dried (reduced to 15 per cent. of moisture).....	12,200	9,070	7,630
Average of kiln-dry material	11,500	9,180	8,550

Well constructed "blower kilns," where the hot air is blown in at one end and escapes at the other (this latter always the entrance end for the material) are giving satisfaction. The best kiln, however, seems to be one in which ample piping in the kiln itself insures sufficiently high (up to 180 deg. F.) uniform temperature in all parts of the kiln, and where the circulation, promoted by a suction fan, is moderate and under perfect control. In

such kilns even timbers of large size can be dried satisfactorily with a temperature not over 150 deg. F.

Effect of High Temperature and High Pressure Processes.—For some time a process employing high temperature under high pressure (temperature over 300 deg. F., pressure 150 lbs.), has been discussed and applied, claiming as a result of the treatment (1) increase in strength; (2) increase in durability; (3) absence of shrinkage.

The result of a series of experiments in which a number of scantlings of longleaf pine, one-half treated, the other untreated, is as follows:

	Bending strength.	Compression strength.
	Lbs. per sq. in.	Lbs. per sq. in.
Treated	7,770	5,600
Untreated	12,340	7,400

The same difference in favor of the untreated material obtained in every single case.

The chemical analyses performed on wood lying side by side along the same radius, being of the same annual rings and same position in tree, gave the following:

PER CENT. OF ROSIN AND PHENOLS CALCULATED TO DRY WEIGHT OF WOOD.

	Treated.	Untreated.
	Per cent.	Per cent.
Rosin:		
Sapwood	1.22	1.64
Heartwood	5.29	6.38
Phenols:		
Sapwood	0.053	0.083
Heartwood	0.180	0.119

It appears that the protective rosin is rather decreased by the treatment, and the antiseptic phenols not increased in an adequate amount to be of value since it requires at least 20 times as much heavy oil in wood impregnation to be effective. It is, however, possible that the change of color due to the process may be accomplished and be produced by the formation of empyreumatic bodies (allied to the humus substances) which may act as preservative against the attacks of fungi.

The claim that the shrinkage of the wood is favorably influenced by the process was not sustained by a series of experiments with oak and pine, which showed that the treated wood absorbs water from air or in the tub, swells and shrinks in the same manner and to about the same extent as the untreated wood.

Effect of Immersion on the Strength of Wood.—The notion frequently expressed is that "soaking wood by floating, rafting, etc., reduces its tendency to decay and shrinkage, but injures its strength." The same was claimed for boiling or steaming preparatory to bending. The last position was disproved by Peter Barlow in the first quarter of this century. The following figures (results of an experiment involving several hundred separate tests) disprove the former assertion.

The soaked wood was kept immersed six months, each piece having its check pieces from the same scantling, which were not subject to the same process, but were tested—one green and one dry. All soaked pieces were seasoned in dry kiln before testing. All values were reduced to 15 per cent. moisture.

Loblolly pine.	Bending strength.	Compression strength.
	Lbs. per sq. in.	Lbs. per sq. in.
Soaked six months and then dried.....	10,820	6,780
Not soaked (mean of green and dry tests).....	10,570	7,000

Effect of "Boxing" or "Bleeding."—"Bleeding" pine trees for their resin—to which only the longleaf and Cuban pine are subjected—has generally been regarded as injurious to the timber. Both durability and strength, it was claimed, were impaired by this process, and in the specifications of many architects and large consumers, such as railway companies, "bled" timber was excluded. Since the utilization of resin is one of the leading industries of the South, and since the process affects several millions of dollars' worth of timber every year, a special investigation involving mechanical tests, physical and chemical analyses of the wood of bled and unbled trees from the same locality were carried out by this division. The results prove conclusively (1) that bled timber is as strong as unbled if of the same weight; (2) that the weight and shrinkage of the wood is not affected by bleeding; (3) that bled trees contain practically neither more nor less resin than unbled trees, the loss of resin referring only to the sapwood, and, therefore, the durability is not affected by the bleeding process.

The following table shows the remarkable numerical similarity between the average results for three groups of trees, the higher values of the unbled material being readily explained by the difference in weight:

Longleaf pine.	Number of tests.	Specific weight of test pieces.	Bending strength.	Compression strength.
			Lbs. per sq. in.	Lbs. per sq. in.
Unboxed trees....	400	0.71	12,358	7,166
Box'd and recently abandoned..	390	0.79	12,961	7,913
Box'd and abandoned five y'rs.	535	0.76	12,586	7,375

The amount of resin in the wood varies greatly, and trees growing side by side differ within very wide limits.

*Extracts from a circular issued by the United States Department of Agriculture, Division of Forestry, B. E. Fernow, Chief of Division.

its. Sapwood contains but little resin (1 to 4 per cent.), even in those trees in which the heartwood contains abundance. In the heartwood the resin forms from 5 to 24 per cent. of the dry weight (of which about one-sixth is turpentine) and can not be removed by bleeding, so that its quantity remains unaffected by the process. Bled timber, then, is as useful for all purposes as unbled.

Strength of Large Beams and Columns.—Owing to the fact that much wood testing has been done on small select and perfectly seasoned pieces usually from butt logs, the values thus obtained seemed to differ very markedly from the results on large timbers usually very imperfectly seasoned, and it was claimed that tests on small sizes always furnished too high values, just as if the differences were due to sizes alone.

While, to be sure, a small piece may be so selected that defects are excluded, the grain straight and in the most favorable position with regard to the load, the assumption of the difference in strength of small pieces from that of large sized sticks has never been made good experimentally.

Since it appears desirable to compare the results from large beams and columns not only with the average data obtained from the general test series on small 4 x 4 material, but also with the average strength of small pieces cut from the same beams and columns, a special inquiry into the legitimacy of such a comparison was made. This study involved over 100 separate tests and proved the very important fact, that uninjured parts of broken beams and columns do not suffer in the test. The large sized beams varied from 4 x 4 to 8 x 16 in.

TESTS OF LARGE AND SMALL BEAMS—BENDING STRENGTH.

Number of tests involved.....	Small beams, general test series.	Large beams.		Small beams cut from large beams.
		Total.	Beams from which small beams were cut.	
	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.	Lbs. per sq. in.
Longleaf.....	11,300	11,500	9,800	10,100
Loblolly.....	10,000	16,800	10,300	10,000
Shortleaf.....	9,300	9,200	8,700	8,700

From the preceding table it would appear that large timbers, when symmetrically cut (*i. e.*, with the center of the log as center of the beam) develop as beams practically the same strength as the average of the small pieces, that may be cut from them and sometimes even higher values; the explanation being that cut in this manner the extreme fibers which are tested in a beam, come to lie in that part of the tree which, as a rule, contains the strongest timber.

Results discordant from these may be explained by differences in the degree of seasoning of the outer layers and also by the fact that especially in the northern pineries timbers are often cut from the top logs which are weaker and more defective.

The square columns were mostly 8 x 8 in., some 10 x 10 in., a few of larger and also some of smaller dimensions. The ratio of length to width varied from 12 to 27, about one-half being under and the other half over 18 to 1. The compression pieces of the regular series, and those cut from the broken columns, were in general about 4 x 4 x 6 in.

TESTS OF LARGE AND SMALL COLUMNS—COMPRESSION STRENGTH.

Number of tests involved..	Regular series from same trees as the columns.	Columns, (simple compression).	Small pieces cut from columns.
	Lbs. p. q. in.	Lbs. p. q. in.	Lbs. p. q. in.
Longleaf.....	6,500	5,300	7,100
Loblolly.....	6,800	4,700	6,300
Shortleaf.....	5,900	4,100	6,200
Cuban.....	7,100	5,100	8,700

It will appear from the statement of average results that columns develop only from 62 per cent. (in Cuban) to 78 per cent. (longleaf) of the compression strength of ordinary short pieces. The explanation may be due to several reasons, natural and mechanical. In a column, unlike a beam, all the fibers are under great strain, hence all the defects, which are by necessity found in every column, influence the results; the flexure of a column under strain is an element of weakness, to which the short compression piece is not subject. In addition the difficulty of determining the average moisture condition of the large timber throughout the cross-section and that of the small pieces cut from them afterward would render this method for columns less satisfactory; a larger number of tests will still be required to establish comparable average conditions in the two kinds of tests. It would, therefore, be unsafe to generalize too hastily from these average figures at least as to the numerical difference, for there are remarkable individual exceptions. Not only do individual columns show differences in strength 50 per cent. and more lower than the compression pieces from the same log, but sometimes they show practically the same or even a higher value of strength, as will appear from the following selected cases, in which the data for the columns are

placed in comparison with those obtained on compression pieces from the same tree:

SELECTED TESTS OF COLUMNS AND COMPRESSION PIECES FROM THE SAME TREES COMPARED.

Number of tree.	Length.	Ratio	Small pieces—Average of whole tree.		Large Columns.		Relative value.		Deflection.	Failure.
			(a)	(b)	(a)	(b)	(a)	(b)		
239	12	14	6,700	6,100	100	91	100	91	0.7	Sheared.
240	12	14	7,000	6,900	100	99	100	99	0.1	Compression.
241	12	15	6,900	6,500	100	94	100	94	0.7	Do.
309	12	12	6,800	6,500	100	96	100	96	0.4	Do.
312	12	16	6,100	6,300	100	103	100	103	0.4	Do.

In these columns (nearly one-tenth of all longleaf pine columns tested) the strength was so nearly the same as that of the short pieces, that it appears as if flexure had but little to do with the failure, the small differences being amply accounted for by a larger number of defects in the columns. Should this prove true in general for wooden columns, as ordinarily designed, the problem would become simply a study of the influence of defects and of proper inspection.

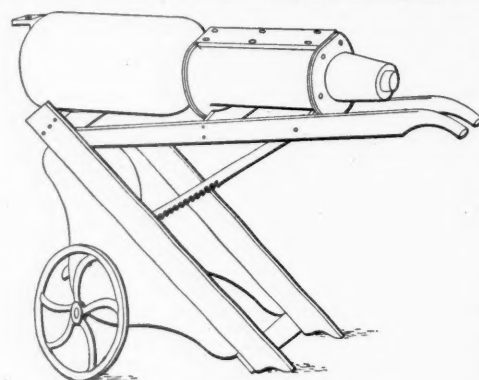
The nature of the failures would also point in this direction:

Of 86 columns 32 failed normally, *i. e.*, in simple compression; 22 were crushed near the end; 14 failed at knots, and 19 by shearing, the rupture usually beginning at or near the ends; a small knot proved sufficient to cause a large column, 20 times as long as its diameter, to fail at 14 in. from the end.

The deflection in the average for all columns (12 to 20 ft. long) was only about one inch for the maximum load, when to be sure, destruction had progressed for some time; at the elastic limit the deflection was only about one half as much. These results would seem to warrant the statement that for pine columns at least, in which the ratio of height to least diameter does not exceed 1 in 20, none of the accepted column formulae are applicable, the nature of the failure being mostly in simple compression, and depending more on specific defects than on the design of the column.

Car-Shop Truck for Brake Cylinders.

The engraving herewith shows a truck which is in use in the car shops of the Maine Central at Waterville for supporting air-brake cylinders while they are being bolted to the car body. The drawing is self-explanatory. The height of the load can be varied to correspond with



Car-Shop Truck for Brake Cylinders.

the height of the car, and the truck really constitutes an adjustable horse. Mr. P. W. Hannaford, General Foreman of the shops, informs us that the truck is easily handled by one man. When shut up this apparatus has the appearance of an ordinary truck.

Electric Traction on Rack Railroads.

BY FRANK B. LEA.

There are several reasons why the use of electric energy as the propelling power on rack railroads should offer great attraction to the engineer as well as the management.

In the first place, the adoption of rack working implies grades too steep for ordinary adhesion locomotives—that is, implies that the line in question is situated wholly or largely in a mountainous region. Therefore, it may safely be concluded that in seven cases out of ten there is a tolerable amount of water power close at hand which can be brought into service at small initial expense.

Secondly, the weight of locomotive when operated by electric energy may be, and usually is, very much less than when steam power is employed. This leaves a greater weight for the train load, and a larger net paying load for a given locomotive horse-power, other conditions being also equal.

In the third place, it is characteristic of most mountain lines to possess a considerable amount of tunneling. The difficulty of properly ventilating tunnels, especially on single lines, where traffic perhaps runs first one way, then another, is notorious when steam locomotives are used. All such trouble is avoided by the use of electric locomotives.

One of the latest projects in Switzerland has peculiar attractions from its very boldness, and a little attention may therefore be worth giving first of all to the proposed line up the Jungfrau.

The greater part of the Jungfrau line is to be in tunnel, and therefore the use of electricity becomes almost essential if passengers are to be carried with any degree of comfort, not to say pleasure. The first mile and a half is open, and the tunnel which follows has a length of 6.2 miles. The grade—25 per cent.—is not steeper than that of many other rack lines already operated with success, as, for instance, the Pike's Peak, Rothhorn, and

Mont Salève. The last named is worked by electricity, as will doubtless be remembered; but the two former, like most of the existing rack lines are operated by steam locomotives with combined rack and adhesion mechanism.

The average speed proposed for the Jungfrau line is five miles per hour, but it is hardly probable that this will be attained in practice; four miles per hour ought to be the maximum speed attempted. A total gross train weight of 20 tons would require at the latter speed 120 H. P. to raise it over the grade above mentioned; and of the 20 tons about six tons would represent the weight of motors and gear mounted on the car and capable of giving this output. This allows nine tons for the car, which should for this weight be equal to a capacity of at least 50 passengers. It is doubtful whether the net paying load would in any case be more than about 20 per cent. of total train weight, but the difference between electrical and steam lines, in favor of the former, will be noticed at once when figures for the latter are given. Take, for example, the Rothhorn line, with equal maximum grade—viz., 1 in 4. Here the steam locomotive weighs 17½ tons and the train 8½ tons, making a total of 26 tons for a maximum net paying load of not more than about 3½ tons, equal to only 13½ per cent. of the total. The same conditions apply to other lines of this kind—*e. g.*, that at Schafberg (Austria), with engine weight of 17.3 tons, and train weight of 10 tons; the Genesio line, engine weight 15 tons, train weight 10 tons (accommodating 56 passengers); and, lastly, the Mont Revard (Aix les-Bains), with engine weight of 17 tons and train weight of 10 tons, carrying 60 passengers. All these lines have a similar grade to that proposed for the Jungfrau. The Pike's Peak line is slightly more favorable to steam traction, though still far less efficient than if operated by electricity; the engine weighs 24 tons and the train weight 19 tons, carrying 100 passengers, or a proportion of, roughly, 14 per cent. for the net live load.

As might be expected, there is ample water power available for the proposed Jungfrau line, a waterfall capable of giving at least 5,000 H. P. existing about five miles from the starting point of the line. The length of circuit out and home would, therefore, be nearly 23 miles. So far as the rail return circuit is concerned, the ohmic resistance for all rack lines is almost negligible, seeing that not only is the whole understructure—rails and sleepers—metallic and inter-connected, but the rack itself forms an additional conductor of no small area. The distance mentioned is not too great for the use of ordinary direct currents, for although the drop of voltage must be heavy for a reasonable size of conductor, yet the source of power being so inexpensive energy can well be wasted in line resistance. The use of a "booster" dynamo at the power-house would overcome any excessive fall of pressure in the furthestmost line section, involving reduced speed in the motors.

The proper or most suitable type of locomotive or motor-car to adopt on an electric rack line involves a subject important enough to require consideration in a separate article, and the writer hopes to deal with the matter in due course at greater length than would at any rate be now permissible. It will be sufficient here to differentiate the motive elements of rack-railway trains into two great classes, according as the lines themselves are of the "sightseeing" or "tourist" order, being merely of short length running to the top of a height; or form part of a "through" line, being then a section or branch of an important thoroughfare. In the former case, although the grades are usually much steeper (ranging up to 25 or 30 per cent.) the loads are not very great, one or two cars for 50 passengers or so being practically all the train required. The motor output is not, therefore, often higher than 100 H. P. to 150 H. P., and motors with gear, etc., to this extent can be fitted up compactly enough below the framing or between the trucks of an ordinary passenger car. Moreover, the deadweight of motive element is not very great, nor yet the total train weight, and therefore no particular advantage results from using the adhesion wheels for driving purposes as well as the rack pinions. Finally, each line being practically self-contained it may be wholly equipped with the rack, and thus offer no difficulties in the way of shunting or making-up trains.

Very different conditions are found to rule with the second class of rack lines. The train weights dealt with are much larger, as they form sections of main line service, and the motive horse powers run up to 400 and 500, although the grades usually are much less, ranging, say, from 1 in 25 to 1 in 8. In such cases it is absolutely necessary to build special electric locomotives which are fitted not only with powerful motors working the rack pinions, but have also other motors driving the adhesion wheels (preferably coupled together), so as to take full advantage of the locomotive weight and relieve the rack mechanism at least to that extent. Obviously the adhesion wheel motors are of great service in shunting and marshalling the trains when off the rack section. There are many points of great interest in the development of such locomotives, but, as already stated, they must be left for full consideration at another time.

Of this second class of line may be mentioned two typical instances from the writer's experience within the past two years, being called upon in both cases to give provisional estimates, etc., for their equipment. The first of these has a total length of 6.62 miles, with an average gradient of 1 in 22. The train loads to be hauled average 150 tons, at a speed of from six to ten miles per hour. Allowing a weight of 50 tons for the locomotive, an output of at least 675 H. P. would be required to pull the gross load of 200 tons at the higher speed; and no little care is necessary in scheming out the best method of splitting up this output among the various adhesion and rack motors.

The second line has points of still greater interest, seeing that it is mostly in tunnel and of much steeper grade, averaging 1 in 8. The train loads are smaller, not exceeding 70 or 80 tons, but owing to the steep grade, locomotives of almost as powerful a type would be required, weighing certainly from 30 tons upward. At a speed of six miles an hour an output of 600 H. P. would be required for gross train loads of 120 tons on this incline.

The type of locomotive suggested for this purpose comprised two bogie trucks fitted with coupled wheels and motors for adhesion driving, carrying a center framework for the rack motors and gear. In both cases intermediate spur gear was proposed, partly on account of the low train speed and comparatively small adhesion motor output, while its employment for the rack motors secures a more convenient framing. Moreover, the rack pinions themselves are merely spur gears with staggered teeth, so that in any case the large motors would work through gearing. The use of spur gear for powerful electric locomotives would seem to run counter to good practice, as carried out on the Liverpool Overhead and South London Railways, where direct driving is employed; but that it has undoubtedly advantages is shown by its adoption throughout the series of large electric locomotives just designed by the Baldwin-Westinghouse combination.—*Electrical Engineer (London).*

Uniformity in Computing Boiler-Tube Heating Surface.

In the 1895 report of the proceedings of the Master Mechanics' Association is a short paper by Mr. F. W. Dean to which it may be well to call attention again as the time for the 1896 convention comes near. Therefore we reprint it below, with the omission of a few words:

There is an existing anomaly in methods of computing the heating surface of the tubes of boilers which ought without further delay to be corrected, and the methods made uniform. This is the difference in practice in using the inside and outside surface of the tubes to express the heating surface; if 2-in. tubes are used, the outside surface is 11 per cent. greater than the inside, which is a very important amount. If a locomotive has 1,500 sq. ft. of inside tube surface, it will possess 1,665 sq. ft. of outside surface. Inquiry of some representative builders of locomotives shows that the following named companies follow the practice placed opposite their names:

Baldwin Locomotive Works.....	Outside
Rhode Island Locomotive Works.....	Inside
Schenectady Locomotive Works.....	Outside
Pittsburgh Locomotive Works.....	Outside
Pennsylvania Railroad.....	"

I do not know the practice of European builders of locomotives, but the English Admiralty use the outside surface, and for the sake of ready comparison and uniformity the United States Navy have, within a few years, and, as I understand, against their better judgment, adopted the same practice.

In deciding which surface shall be employed, it is necessary to consider what heating surface really is. I define it as the surface, of whatever kind, in contact with the source of heat, and by source of heat I mean the hot gases evolved by the process of combustion. The tubes are a necessary medium between the gases and the water, and it is they that extract the heat from the source and merely transfer it in a more or less perfect manner to the water. They represent the water, so to speak. For this reason, viz., that their fire side takes the heat from the source, their fire side, or inside in locomotive boilers, should be used in computing heating surface.

In considering this matter, if the tubes stored up heat from the gases and then gave it off to the water, there might be an argument in favor of the outside surface. The capacity of a tube, however, to give its heat to the water is so enormous and so far in excess of its power to take heat from the source, that, as is well known, its own temperature is about that of the water.

This is very clearly shown by the behavior of the Serve internally-ribbed tube, for so perfectly does this tube give up its heat to the water that the ribs suffer no harm from over heating. A further consideration of the Serve tube will assist in making this matter clear. This design adds to the fire surface of the tube and not to the water surface. If the water surface be considered, a boiler fitted with Serve tubes is rated only equal to one with plain tubes, and yet it has the capacity of a boiler of much greater heating surface. By using the fire surface the Serve tube is credited with what in effect it possesses, viz., greater heating surface than the plain tube.

Consider also the plain tube pushed to an extreme thinness. The thinner the tube is the better will it perform its function. If it could be made infinitely thin, a boiler possessing it would have its best qualities, and equal to those of a boiler with a greater number of thicker tubes. The boiler with the infinitely thin tubes would have its inside and outside surfaces coincident, and would, therefore, have its heating surface equal to the inside surface of the tubes.

If, now, the outside surfaces of tubes constitute boiler heating surface, this surface can be augmented by increasing the thickness of tubes. This is, however, a means of retarding the flow of heat through the metal of the tube, and, therefore, of virtually decreasing the heating surface instead of increasing it.

These arguments clearly show to the writer that the outside surface is a misrepresentation of the heating surface, and that the thicker the tube the greater the misrepresentation becomes.

The Railroads of Japan.

Mr. Gerard Lowther has drawn up an exhaustive report on the railroads of Japan which has been recently forwarded to the Prime Minister by the British Minister at Tokio. From this document *Transport* (London) draws a good many interesting facts, a few of which we print below. The total mileage of railroads is given as 2,118 and the population as 41,388,313.

At first some 200 foreigners were employed on railway construction and management, but the Japanese Government dispensed with their services as soon as possible. In 1882 only 21 of these remained, and in 1895 there were only six in the employ of the state. These latter are now only utilized for exceptional work and for purposes of consultation, and are no longer occupied with the management of the lines, which rests entirely in Japanese hands.

For the capital required for the construction of the lines Japan also depends upon herself, foreign capital being excluded, except in the case of the first railway, in which recourse was had to foreign markets. The total amount of railway mileage open to the public twelve months ago was: Government lines 580 miles, and private lines 1,538 miles, making a total of 2,118. Upon the Government lines already in existence a sum of £8,097,500, or 39,500,000 yen, has been expended. The cost of the construction of the first line—that from Tokio to Yokohama, which is a double line—amounted to £32,000 per mile. The second line, namely, the Kobe-Otsu, cost £28,500 per mile; but in this has to be included very important workshops. Since these were built, however, the cost of building has been materially decreased, and those since completed may be reckoned upon having cost on the average £12,000 per mile.

On the same 3 ft. 6 in. gage the cost on 1,396 miles in New Zealand was £7,595, and on 1,207 miles in Queensland £6,302 per mile. For the railways now to be built the estimate is now set down at £3,500 per mile—a very moderate price certainly. It has to be borne in mind that all the lines, with the exception of the Tokio-Yokohama and a few similar ones, amounting in all to 69 miles, are single lines, that the lines are practically confined to flat districts, and that the cost of labor is extremely low. It is estimated by the Japanese officials that about one-third of the total sum spent in the construction of lines has to be expended in the purchase of materials, such as bridge work, locomotives, rails, and fastenings from abroad. The average cost per mile for building all the railways at present working is estimated up to the end of the year 1894-95 as \$65,861.

No little criticism has been passed upon the authori-

ties in consequence of their having adopted the 3 ft. 6 in. gage, but it seems that the choice was made on the advice of foreign experts, and this decision was greatly influenced by the discussion at the time taking place in England and India on the relative advantages of building all future railways in our great dependency on the meter gage. At that time a discussion took place as to the desirability of making provision for doubling the lines in the event of future traffic requiring it. The large increase of capital which would, however, have been required militated against a decision in that direction. To enable people to form an estimate of the outlay required to alter the gages now the example of India is cited, where 145 miles of the Bengal-Nagpur Railway were altered from the meter gage to the 5 ft. 6 in. gage, and the cost of the operation was £2,700 per mile. This would mean that to alter the railways of Japan from the 3 ft. 6 in. gage would involve a cost of about £5,000,000. The time for this has evidently gone by, for the carrying of it out would require the reconstruction of the whole of the rolling stock, the rebuilding of bridges, and the reboiling of tunnels—an inconvenience and cost far too great to compensate for such a trifling gain.

As far as speed is concerned, it would hardly be possible to make any increase without a reconstruction of the permanent way, and to do that would call for an increase of fares. In Japan time is considered to be of little value, and so it is thought that slow trains and moderate rates would probably be found more attractive to the public than higher fares with greater velocity. The speed of the railways of Japan range from 16½ to 18½ miles, whereas the highest speed of those of India are about 20½ miles.

A feature of the Japanese railway system, which is worthy of note, is the fact that in the main island the railways were built by English engineers, and that English locomotives and rolling stock were brought into use, to be followed, however, later by a few American and German locomotives. In the northern island the first 50 miles of railway were built by Americans, and the rolling stock, etc., is American; but English methods were followed in subsequent extension, and in Kiushiu the lines were built by Germans, and German rolling stock employed. An engine has been built at Kobe, but by an English engineer, Mr. R. F. Trevithick, M. Inst. C. E., and more are in process of construction under his supervision, the material being imported from Great Britain. This locomotive was finished in May, 1893, in the Government shops in Kobe, and has proved to be an unqualified success, and during the first two years ran 57,473 miles. In price it compared very favorably with those imported, its total cost amounting to \$8,992, or, at the then rate of exchange of 3s. to the dollar, £1,349.

In April, 1894, there were 140 locomotives on the Government lines, while the private lines owned 142. The cost of American locomotives was 10 per cent. higher than those purchased in Great Britain, and their consumption of coal 14 per cent. higher. As far as locomotives are concerned, Japan stands in much the same position as India, but with respect to vehicles for the carriage of merchandise Japan holds the lowest place. This is accounted for by the fact that the country consists of islands, that the principal railway runs along the coast, and that there are three ports at which nearly all the principal lines of steamers touch, thus rendering it impossible for the railway to compete with the steamship carrying trade between the ports. The result is that the proportion of earnings from goods traffic is very small, being only 20 per cent. as against 52.8 per cent. in the United Kingdom, 66 per cent. in the United States, 72.3 per cent. in Germany, and 77 per cent. in Austria-Hungary.

The first and second-class passengers form a very small proportion of the traveling public—certainly not more than 6 per cent. of the whole. A comparison of the third-class fares with those in operation in this country and Germany, shows that whereas in England the fare is about 8s. per 100 miles, and in Germany about 7s., in Japan it is only 2s. In other words, third-class traveling costs in Japan just a quarter of what it does in England. The total number of passengers carried on the railways of Japan in the year 1894-95 was 36,641,113, that is to say, 14,883,986 on the Government lines, and 21,757,127 on the private lines.

The total traffic returns for the past year on Government lines show an increase of 16 per cent. over those of the previous year. The coaching receipts show an increase of 12.7 per cent.; the number of passengers 3.04 per cent., and the average mileage per passenger has increased by 13.4 per cent. The goods receipts were also increased by 27.8 per cent.; the goods tonnage shows a decrease of 5.4 per cent., but the average mileage increased by 39 per cent. The train mileage shows an increase of 12 per cent. The traffic returns of the various lines show a pretty general increase, but this is in large measure the result of the general development of the railway service. The gross revenue for the year 1894-95 was \$5,819,413—an increase of \$494,958. Of this increase \$318,752 fell to the coaching traffic, and \$124,133 to the goods. The working expenses for the year amounted to \$2,181,696. The largest proportion of the expenditure was in connection with the locomotive department, the amount being \$1,058,313. The actual expenses of working the traffic appear to have been only \$500,406. The increase in the locomotive expenses is accounted for by the fact that the running mileage showed an increase over the previous year of 800,000 miles. The gross capital invested in Japanese railways amounts to \$42,661,167, and the profit last year amounted to \$3,643,654. This gives a net profit of 8.5 per cent. on the capital. Hitherto Great Britain has practically had a monopoly in furnishing rails, locomotives, and rolling stock for Japan. But the tendency of the Japanese Government is to dispense with all foreign advice, and the time is probably not remote when all Japanese lines, Government and private, will be built and managed without any assistance from the foreigner in Japan, and the material alone will be purchased abroad. On some technical points our manufacturers are placed at a disadvantage with America. It is suggested, therefore, that manufacturers of railway material would find it to their interest to be represented in Japan in the same manner as the large shipbuilding firms of Great Britain are represented, and as signs are not wanting of a considerable extension of railway enterprise, it is important that this recommendation should be acted upon without delay.

Foreign Railroad Notes.

The Belgian State Railroads at the beginning of 1894 measured 2,044 miles and had cost \$27,323,071, or \$133,674 per mile of road. The gross earnings in 1894 were \$14,415 per mile, and the net earnings 4.43 per cent. on the capital invested. It is now reported that the state, which has heretofore for many years increased very slowly its system, and worked little more than one-half of the railroads of the Kingdom, will now absorb the private rail-

roads, the chief of which is the Belgian Great Central. Heretofore Belgium has been the classic country of the "mixed" railroad system.

To show the effect of the new Prussian state railroad organization, Minister Thielen cites the fact that with 1,500 miles more railroad the number of employees is less by 3,200.

TECHNICAL.

Manufacturing and Business.

The Pennsylvania is treating over 1,000 large bridge timbers with woodline at its specially designed tank at Pavonia, N. J. These timbers vary in size from 10½ ft. to 25 ft. in length. Woodline has been used a good deal in treating cross-ties, but the simple method of treating the material would appear to make it peculiarly adapted for treating large timbers as the Pennsylvania is doing. Woodline is made by the American Wood Preserving Co., of Philadelphia.

The New York Belting & Packing Co. has recently received orders for its interlocking rubber tiling on four steamers and a train of cars. The interlocking feature, preventing the displacing of the tiling, makes this material well adapted for use where there is vibration, as on steamers and railroad cars.

New Stations and Shops.

The National Switch & Signal Company is to build an addition of brick and steel, 50 ft. x 150 ft., to its signal plant at Odenweldertown, near Easton, Pa. The new building will be used as the wood-working department and the space gained in the main building by the removal of the work of this department to the new building will be used by the electrical department.

The Galveston Union Depot Co., will be organized to build the proposed Union station at Galveston, Tex., the capital stock being subscribed by the Gulf, Colorado & Santa Fe whose officers originated the project and have been most active in the matter; the Missouri, Kansas & Texas, the Galveston, La Porte & Houston and perhaps the International & Great Northern, that company not yet having definitely decided whether to accept the site of the proposed Union station or build a new passenger station for its own use. The Union station will be erected on Strand street near 25th street.

The contract for building the new repair shops of the Northern Pacific at Spokane, Wash., has been awarded to George McKenzie, of Spokane. The foundations of many of the buildings have been completed and the roundhouse is to be completed by Aug. 10 and all the other buildings by Sept. 1, next. The roundhouse will have 22 stalls and the dimensions of the other buildings are as follows: Machine shop, 70 x 113 ft.; blacksmith shop; boiler and coal room, 76 x 79 ft.; car shop, 60 x 300 ft.; wood-working shop, 60 x 100 ft.; office and store house, 36 x 100 ft.; oil house, 25 x 40 ft.; sand house, 25 x 44 ft.

Plans for the new Union station to be built at Columbus, O., by the Pennsylvania and the Cleveland, Cincinnati, Chicago & St. Louis were approved at a meeting of the officers of these companies at Cincinnati last week. Contracts for certain of the work were also awarded. The building will be of stone and brick, and with the other improvements it is estimated will cost \$500,000. The two roads named will be the joint owners of the new station, but it will be used by other lines entering Columbus.

The Missouri, Kansas & Texas will open its new passenger station at Sedalia, Mo., on May 10. The building has been erected at a cost of about \$35,000. Heretofore the company has used the yards and other terminals of the Missouri Pacific at this point.

The Norfolk & Western will, during the coming summer, build the shops at Kenova, W. Va., which have been in contemplation since the Ohio River extension of the road was completed, and for which the plans have been made for two years.

The Southern Railway is building a 21-stall roundhouse, at Charlotte, N. C.

Iron and Steel.

The annual meeting of the stockholders of the Pennsylvania Steel Co. was held at Philadelphia on May 4, and the following Directors, who were recommended by the Reorganization Committee, were elected: E. C. Felton, Harrisburg; L. S. Bent, Philadelphia; E. B. Morris, Philadelphia; F. W. Hunnewell, Boston; John Cassels, Washington; Alfred Earnshaw, George Wood, C. Stuart Patterson and E. R. Dick, Philadelphia. The Directors will meet for organization in a few days, and then E. C. Felton, who is the present General Manager of the company, will be elected President and General Manager. The property of the company, which went into the hands of Receivers on April 21, 1893, was transferred by the Reorganization Committee to the security holders at the annual meeting. The necessary legal requirements will occupy some time, and it is not likely that formal possession will be taken for some weeks. The report of the Reorganization Committee, which has been acting as directors of the company since its reorganization, stated that the sales and deliveries during 1895 amounted to \$6,679,956. The net profits during the year were \$121,657.

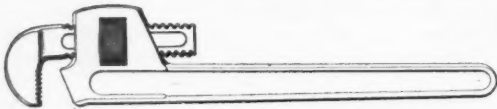
The Dodge Chain Patents.

Judge Dallas, of the United States Circuit Court for the Eastern District of Pennsylvania, has filed an opinion granting the Ewart Manufacturing Co., a preliminary

injunction against James H. Mitchell, restraining the latter from the manufacture of an alleged infringement of the plaintiff company's patented chain known as the "Dodge Chain," and manufactured by the Link-Belt Engineering Co., of Philadelphia, and the Link-Belt Machinery Co., of Chicago.

The Star Wrench.

The Van Auken Steam Specialty Co., of Chicago, is making a wrench of very simple construction, which is shown in the accompanying figure. It is made of three parts, which are very strong. The parts are interchangeable, and if one part becomes worn, it may be replaced. The shape of the heel is one of the principal features; it



will be noticed that this is cut on an angle instead of parallel to the face of the jaw. This enables the operator to release the wrench from the pipe or bolt quickly and easily, although when in use it grips the pipe firmly without lost motion. An advantage of this is that the wrench will ratchet a nut or coupling without marring the same or rounding the corners.

A Locomotive Coaling Plant.

The coaling station of the new shops of the Cleveland, Cincinnati, Chicago & St. Louis Railway, at Wabash, Ind., is described and illustrated in the May issue of the *American Engineer*. Here the coal and the ashes are handled by conveyors. The chute has 10 coal pockets and two ash pockets. It stands between two tracks, one for the locomotives when being coaled, the other for the cars which bring coal or carry away ashes. The building is 92 ft. 3 in. long and 14 ft. wide, with an 18-ft. extension at one end for the engine and boiler. When coal is received in hopper cars it is dropped directly into a hopper in a pit between the rails. Thence it is delivered to an inclined conveyor which carries it to the top of the building at one end. Here it is dumped on an inclined chute which delivers the coal to a horizontal conveyor which passes over the pockets. Over each pocket is a gate worked by a rack and pinion, so that coal may be dropped into any pocket from the conveyor, and on each pocket are battens to indicate the height to which they must be filled for two tons, three tons, etc. From these pockets the coal is delivered to the locomotives. If the coal is received in flat-bottom cars it is shoveled to a horizontal conveyor which carries it to a chute which delivers it to the inclined conveyor before described. An ash pit 28 ft. long is placed between the rails in front of the engine and boiler house. The bottom of this pit consists of cast-iron gratings in short sections and under these is a screw conveyor running the whole length of the pit, which delivers the ashes to another screw conveyor at right angles to it which in turn carries them to an elevator, which takes them to the top of the building and delivers the ashes into two ash pockets. The horizontal screw conveyor at the bottom of the pit is fed by removing the plates one by one. The ashes are delivered from the pockets into cars as is necessary. This plant was built for the company by the Link Belt Machinery Company. Three men are required when it is in full operation, but they do not give their entire time to it.

Buffalo Grade Crossing Contracts.

The Grade Crossing Commission of Buffalo, at a meeting last week, gave orders for the immediate preparation of the contracts with the railroad company for the work on the line of the New York Central between Seneca street and William street, also at Seneca and Smith streets. The structure at the latter point will be nearly half a mile long. The Engineer of the Commission was directed to prepare plans and specifications for the improvement at Chicago street, in which both the New York Central and the Erie are interested. These plans are already nearly finished and bids will be advertised for soon. The Michigan street viaduct is now nearly completed and the engineer expects that it will be open for traffic within a week. The plans of the Commission have been somewhat thwarted by the failure of the legislature to pass a bill facilitating the acquisition of real estate for the widening of streets. At points where such widening is necessary and cannot be advantageously effected without the desired legislation, the beginning of the work will have to be postponed until next year. The Western New York & Pennsylvania and the New York, Chicago & St. Louis ask for further delay in the matter of the contracts between those roads and the Commission.

Dodge Coal Storage System on the Erie.

The Erie Railroad Co. has contracted with the Dodge Coal Storage Co., of Philadelphia, for a 150,000-ton storage plant at East Buffalo, N. Y. The coal will be stocked in nine divisions or piles, each of about 17,000 tons capacity. The plant will be constructed under the patents of the Dodge system, with the latest improvements, including a complete haulage system for handling cars.

Some Coupler Tests.

The Shickle, Harrison & Howard Iron Company, of St. Louis, recently received an order for 200 couplers from a western railroad. The specifications under which these couplers were furnished reads, in respect to test, "One complete coupler will be selected by the railroad company's inspector, for test, from each lot of 51 couplers offered, or from each heat if more than one heat is represented in the lot of 51 couplers offered. The test coupler thus selected must stand the following drop test,

the coupler to be placed upon a large steel anvil resting upon a heavy stone foundation and struck with a 1,640-lb. weight:

Knuckle Test.			
3 blows of weight falling	5 feet.		
3 " " " "	10 " "		
2 " " " "	15 " "		
Guard Arm Test.			
3 blows of weight falling	3 feet.		
5 " " " "	5 " "		

"If the test coupler fails to stand either of the above tests, the 50 couplers it represents will be rejected. The test coupler must break into two or more pieces before it will be considered a failure."

The order was not enough to make a special lot, but they were run in with other work, which accounts for the number of heats represented, and incidentally exhibits the quality of the regular output. These couplers were shipped in two lots of 100 each, and each lot was tested separately; a coupler from each heat represented in each lot having been taken for test. The results of the tests were as below:

First Lot.			
Test Coupler No. 1.	Guard Arm Test.	Heat No. XI.	
3 blows of 1,640 pound weight falling	3 feet.		
15 " " " "	5 " "		
10 " " " "	10 " "		
1 " " " "	15 " "		
Remarks—Guard arm broke off.			
Test Coupler No. 2.	Guard Arm Test.	Heat No. XII.	
3 blows of 1,640 pound weight falling	3 feet.		
15 " " " "	5 " "		
3 " " " "	10 " "		
3 " " " "	15 " "		
Remarks—Head of coupler broke off.			
Test Coupler No. 3.	Knuckle Test.	Heat No. XIII.	
3 blows of 1,640 pound weight falling	5 feet.		
3 " " " "	10 " "		
4 " " " "	15 " "		
Remarks—Knuckle broke, shank of draw bar bent.			
Test Coupler No. 4.	Knuckle Test.	Heat No. XIV.	
3 blows of 1,640 pound weight falling	5 feet.		
3 " " " "	10 " "		
7 " " " "	15 " "		
Remarks—Knuckle broke, shank of draw bar bent.			
Second Lot.			
Test Coupler No. 1.	Guard Arm Test.	Heat No. XVI.	
3 blows of 1,640 pound weight falling	3 feet.		
15 " " " "	5 " "		
Remarks—Stem broke off under head.			
Test Coupler No. 2.	Knuckle Test.	Heat No. XVII.	
3 blows of 1,640 pound weight falling	5 feet.		
3 " " " "	10 " "		
7 " " " "	15 " "		
Remarks—Knuckle not broken. Stem of draw bar broke below head. End of stem also crushed.			
Test Coupler No. 3.	Knuckle Test.	Heat No. XVIII.	
3 blows of 1,640 pound weight falling	5 feet.		
5 " " " "	10 " "		
5 " " " "	15 " "		
Remarks—Knuckle not broken. Head of draw bar broke Stem cracked also.			

It will be observed that every coupler much exceeded the requirements. The tests were made at the railroad shops and entirely under the direction of the railroad's officers.

The Electrical Exposition.

The National Electrical Exposition was opened at the "Grand Central Palace," New York, by Governor Morton, on Monday evening of this week. Very few of the exhibitors, however, were in readiness, and it will be a few days yet before it will be seen at its best. The large electric companies have made no attempt to make an extensive exhibit, the matters of chief interest being more in the line of curiosities.

W. J. Hammer's large collection of portraits of prominent electricians, Charles Depoele's electrical railroad relics, the motorcycles, Edison's new inventions, and the model of the Niagara Power Company are of especial interest. The Gold Company is exhibiting its new electric heater. The resistance coils of the heater are an inch and a quarter in diameter and three coils high, one placed directly above the other in a horizontal position. These coils are secured in position by slight grooves in the solid asbestos boards, so that in event of a wire breaking, it would be impossible for it to leave its original position, thereby avoiding any short circuit or burning of wires. The composition of these wires is held a secret by the company.

Among the models loaned by the technical schools is one made by Mr. Garry, of Stevens Institute, which illustrates the method used in connecting the wires in the polyphase system of lighting and power transmission. Mr. Max Osterberg, of Columbia, has charge of this department of the exhibit.

M. C. B. Association—Subjects for 1897.

The Committee on Subjects for the 1897 Convention requests that each member of the Association send to the Chairman a list of one or more subjects desirable for committee work during the coming year. The Committee also asks for suggestions of subjects for topical discussions for the noon hours during the 1896 Convention. Replies to be sent to A. M. Waitt, Gen. M. C. B., Lake Shore & Michigan Southern Railway, Cleveland, O., not later than June 1, 1896.

The B. & O. Electric Locomotives.

The last of the three electric locomotives for the Baltimore & Ohio tunnel has been shipped from the Schenectady works of the General Electric Company. As soon as the third locomotive reaches Baltimore it will be assembled and placed on the tracks. They will then haul the passenger trains as well as the freight trains.

The Temperley Transporter.

Mr. Spencer Miller, Engineer of the Cableway Department of the Lidgerwood Manufacturing Company, New York City, who has recently returned from Europe, secured while abroad the American rights under the patents of the Temperley Transporter, which the Lidgerwood company will immediately put on the market. The transporter is a hoisting and conveying device, em-

ploying a suspended beam as a trackway. The chief points in its favor are simplicity in operation, low cost and extreme flexibility. About 300 transporters have already been made, and the device has therefore passed through its experimental stage. The British Admiralty has adopted the Temperley transporter for coaling battle-ships, having recently purchased nearly 100 of them. Mr. Miller also secured a contract in Paris from the new Panama Canal Co. for seven cableways, which were shipped April 30 to Panama.

THE SCRAP HEAP.

Notes.

The street railroad conductors and motormen in the city of Milwaukee to the number of about 1,000 struck on May 4, and only nine cars were run in the city on that day.

The secret service agents of a number of Western railroads held a meeting in Kansas City last week and formed an organization. We have not learned the name of the society. Another meeting will be held at Omaha, Oct. 13.

The change of grade of the New York, New Haven & Hartford Railroad in Brocton, Mass., for the purpose of abolishing 13 grade crossings has been so far completed that the main tracks are now ready for use throughout the new grade. The new passenger station will not be finished until autumn. This work, under the charge of Mr. J. W. Rollins, Jr., was begun in July 1895 and has been rapidly carried out. The expenditures to date amount to about \$1,400,000. The *Boston Herald*, from which we take these facts, says that the city of Brocton, now has no grade crossing within its limits.

The railroad commissioners of various states resolved last year to send to the Washington convention this year a resumé of the work done by each during the year. The Texas commissioners, in forwarding information for this report, state, among other things, that they have not yet made rates for the express companies, for the reason that none of those companies have general offices in Texas, where they can get the necessary information to enable them to determine what rates would be reasonable. The Commissioners have urged the Legislature to require the express companies to have general offices in that state. The reason for the law under which the Texas Commission has engaged engineers to make a detailed valuation of all the railroads of the state is given as follows:

The purposes of these valuations and the regulations for the issuance and registration of stocks and bonds are to prevent the issuance of fictitious and fraudulent stock and bonds, to protect the patrons of the roads against freight and passenger rates to pay dividends and interest on such stock and bonds; to protect investors of capital in such railroads against the impairment of the value of their investments by the issuance of such fictitious stock and bonds; to give steady and permanent value to railroad property and securities the same as in investments in other kinds of enterprises and to furnish a just basis for the making of freight and passenger rates.

Registered R. R. S. Letters.

The Boston & Maine has recently begun registering important letters and packages, on a plan similar to that employed by the government for the registration of letters and packages. Blue stamps, numbered and labeled "Boston & Maine Railroad, Registered Package," are affixed to each package or letter for which special care is desired and the baggage men are required to record the package on the train report or transfer way-bill, the same as a piece of baggage. The stamps are about the size of a special delivery stamp.

Horseless Carriages.

Mr. John Lundie and Mr. L. L. Summers, Consulting Engineers, of Chicago, recently gave an illustrated lecture on motorcycles before the engineering students of University of Wisconsin.

The Fortune of a Superintendent of Motive Power.

The will of the late Mr. Patrick Stirling, Locomotive Superintendent of the Great Northern Railway, has been proved at the District Registry of Wakefield, the value of the personal estate being sworn at £118,750.—*Herald's Journal*.

Another Railroad in China.

In a report to the State Department Mr. Charles Denby, United States Minister to China, says that the Imperial sanction has been given for the construction of a railroad between Shanghai and Swatow, a distance of sixty-five miles. Part of the stock is to be sold in open market and the rest to be held by the Government. Only Chinese shareholders are to be admitted, and no foreign capital will be allowed in the company under any form or disguise.

Lake Front Park, Chicago.

Work has been begun at Chicago on the depression of the grade of the Illinois Central Railroad, under the contract between the road and the city for the re-grading of the Lake Front Park. This improvement extends from the northern terminus of the road at Van Buren street, formerly the central station, southward to Twelfth street, the location of the present principal passenger station. For this distance, about 6,000 ft., the tracks are to be lowered about 4 ft., and a retaining wall built along the west side of the railroad and earth filled in, so as to bring the level of the park up to about 16 ft. above the grade of the track. The construction of overhead bridges to connect the park, and the streets of the city, with the wharves along the lake shore, east of the railroad, with easy approaches, will then be feasible. The estimated cost of the whole improvement is \$1,500,000. For most of the distance between Van Buren and Twelfth streets there are now 12 tracks on the railroad's right of way, and for nearly the whole distance there will be 15 tracks on the new grade.

Light Business.

Press reports state that retrenchments are still being made by the Atchison, Topeka & Santa Fe. The com-

pany will close its city ticket offices at Atchison, St. Joseph and Lawrence, and it is said that local ticket offices will be closed at other points where union offices are maintained. The district passenger agencies of the Grand Trunk at Detroit, Buffalo, Ogdensburg and Boston are to be abolished. There will be ticket offices at Ogdensburg and Detroit, and at Boston the Central Vermont will attend to the Grand Trunk's passenger business. On the Wyoming division of the Lehigh Valley Railroad 77 brakemen have been laid off. Heretofore every through freight train was manned by a conductor, three brakemen and a flagman, and every pusher engine by an engineer, fireman and flagman. Press reports state that under the new order one brakeman is taken off each freight crew and the flagman is taken off the pusher.

The Limitations of Railroad Competition.

There may be a number of good reasons for demanding the dissolution of the Joint Traffic Agreement of the trunk lines, but it sounds rather foolish to place among these the claim that the agreement constitutes a railroad trust and a combination in restraint of commerce. Everybody knows that unrestricted railroad competition tends to unsettle all business. When rates are demoralized manufacturers and shippers do not know how to regulate their own business. They do not know how to treat with their customers. Stability is of great importance to the business interests of the country. The Senate Committee of 1886 found that the more competition there was among the railroads the less chance there was for free competition in the sale of the products which they carried. Secret cutting of rates and sudden fluctuations were demoralizing to all business except that of a purely speculative character.

The Joint Traffic Agreement does not constitute a pool, but it does provide for the strict adhesion by every railroad in it to the published rates. On its success in doing this must depend its right to exist. In railroad business the danger of monopoly lies in the direction of general bankruptcy, not in that of prosperity. For, the better a railroad pays the more likely it is to have a rival, and the more bankrupt railroads there are the more certain it is that, eventually, a single ownership will be reached which is able to dictate its own terms.

Cut-throat competition among railroads enriches nobody but a few favored shippers. It is a matter for regret that the Interstate Commerce Commission should appear as the plaintiff in a suit to dissolve an agreement whose ostensible purpose is to check the excesses of railroad competition, and hold all the parties to it to a strict observance of the law. Governmental authority is needed not so much to protect the public against the railroads as to protect them against each other. To confound the effort to prevent destructive competition with the organization of trusts and combinations in illegal restraint of trade is to make a blunder of twofold significance. For all commercial monopolies thrive on unrestricted railroad competition, and railroad monopoly is the result of such competition.—*Journal of Commerce*, New York.

A Quick-Action Health Resort in Missouri.

The latest railroad romance from Chicago is not original with the reporters; they got it from a lawyer. It describes a lawsuit against the Pullman Company, by a man who is suffering from inflammatory rheumatism because his train did not make time. He has filed a bill in the Superior Court asking for \$100,000 damages against the Pullman Palace Car Company and the St. Louis, Iron Mountain & Southern Railway. While traveling to Chicago three years ago the train was delayed by a washout at a small town in Missouri for two days. Plaintiff alleges that he has been a great sufferer from inflammatory rheumatism since, and some of his joints have been broken to stop the process of ossification.

Passes in England.

Even in England the railroad manager who wishes to influence a legislator by giving him a pass can find the opportunity to do so now and then, if he looks about. The *Railway News* (London) prints a letter from a stockholder of the London & North Western, who says: I am pleased with your remarks on the opposition offered to the second reading of this company's bill in the House of Commons. [Quoted in the *Railroad Gazette* of May 1, page 310.] A short time since persistent attacks were made on this company, which were not altogether unassociated with the decision of the directors to refuse the issue of "free passes" to Members of Parliament and their agents on business "connected with the company." This privilege of "free transit" is very largely recognized in the United States and Canada, and other countries. I do not assume for an instant that the Members of Parliament and their agents are influenced in the slightest degree by the little "attentions" which they ask of the companies, but, as a matter of principle, I object to a system which makes me pay the cost of their traveling.

The Black Diamond Express.

The Lehigh Valley will, on May 18, put on a new daily express train each way, between New York and Buffalo, leaving each city at noon and arriving in Buffalo at 10 o'clock, p. m. and in New York at 10:30 p. m. The distance from Jersey City to Buffalo is 447.6 miles and the time, allowing 12 minutes for the ferry, is 9 hours and 48 minutes, making the inclusive speed 45.7 miles per hour. These trains are composed of, first, a combination baggage and café car; second, two Pullman-built coaches with lavatories and smoking rooms, and finally an observation car with a ladies' room, which latter contains writing tables, papers and magazines and books. The trains are lighted by Pintsch gas, heated by steam and vestibuled throughout with the Pullman extension vestibules. Some weeks ago the General Passenger Agent sent out a circular asking for a name for these trains and offering a prize of \$25 for the name selected. More than 35,000 answers were received and the winner was Mr. Charles M. Montgomery, of Toledo, O., who suggested the name adopted—namely, "Black Diamond Express."

LOCOMOTIVE BUILDING.

The Lehigh Valley, it is stated, is asking bids for six new passenger engines, similar to the engines used on the Atlantic City Division of the Philadelphia & Reading. The order for the 25 new freight engines, which was referred to last week, will be given out immediately.

The Brooks Locomotive Works, of Dunkirk, N. Y., report the following orders in hand: Six locomotives for the Adirondack & St. Lawrence, (two with 20-in. x 26-in. cylinders, three with 18-in. x 26-in. and one heavy freight engine with 21-in. x 26-in. cylinders, also seven for the Burlington, Cedar Rapids & Northern, three 10-wheel

passenger with 18-in. x 26-in. cylinders; and four 6-wheel switching engines with 18-in. x 24-in. cylinders; also three for the Munising Railroad in Michigan (two 16-in. x 24-in. moguls and one 18-in. x 24-in. 8-wheel).

CAR BUILDING.

A private car for Vice-President George A. Burt, of the Ohio River road, has just been completed in the company's shops at Parkersburg, W. Va.

BRIDGE BUILDING.

Asbury, N. J.—The contract for building an 86-ft. iron bridge here has been awarded to the Vulcan Road Machine Co., of Charlestown, W. Va.

Brookings, S. D.—The bridge across the Sioux River has been condemned and a new one will be built.

Cassville, Wis.—It has been voted to build a highway bridge over Furnace Branch.

Duquesne, Pa.—It is reported that the Carnegie Steel Co. will build a bridge over the Pennsylvania Railroad tracks from the mill yard to the new office.

Fort Madison, Ia.—Bids will be received until June 2 for the construction of all iron and combination bridges for the year. Address the Chairman of the Board of Supervisors, or J. Rose Robertson, County Engineer, Fort Madison, Ia.

Freemansburg, Pa.—The bids for the highway bridge over the Lehigh have been opened by the Commissioners. Bids were asked on three plans: a, for a single span with grade crossing at the Lehigh Valley tracks; b, for one large span and one small one over the railroad tracks; c, two spans of equal size, overhead crossing. The bids for the three plans in the above order were as follows: Wrought Iron Bridge Co., Canton, O., \$25,000, \$34,000, \$33,000; Pascoe & Crilly, Allentown, Pa., \$26,500, \$33,852, \$30,375; Smith & McCormick, Easton, Pa., \$27,894, \$34,639, \$34,000; Nelson & Buchanan, Chambersburg, Pa., \$30,200, \$40,200, \$38,700; Dean & Westbrook, New York, \$31,131, \$39,306, \$39,600; New Jersey Steel & Iron Co., Trenton, N. J., \$32,000, \$41,000, \$38,500; King Bridge Co., Cleveland, O., \$36,000, \$34,900, \$35,000; Groton Bridge Co., Groton, N. Y., \$28,051, \$36,800, \$35,800; S. B. Mutchler & Co., Phillipsburg, N. J., \$25,975, \$36,252, \$34,424; Lehigh Construction Co., South Bethlehem, Pa., \$25,308.50, \$34,282.12, \$33,100. The engineer's estimate of the cost of the three proposed plans was \$25,438, \$34,335 and \$33,023. The bridge will be 369 ft. 9 in. long.

Galesburg, Mich.—A wooden bridge is to be built across the Kalamazoo River. There was an effort made to have the bridge of iron or steel, but the electors voted against it.

Glen Gardner, N. J.—Bids have been received as follows for building an 80-ft. bridge here: Horseheads Bridge Co., Horseheads, N. Y., \$1,130; Wrought Iron Bridge Co., Canton, O., \$1,260; King Bridge Co., Cleveland, O., \$1,150; Vulcan Road Machine Co., Charlestown, W. Va., \$1,060; Nelson & Buchanan, Chambersburg, Pa., \$1,190; Berlin Iron Bridge Co., East Berlin, Conn., \$1,200; Dean & Westbrook, New York, \$1,175; Kirk, of Plainfield, N. J., \$1,175; Tippet & Wood, Phillipsburg, N. J., \$1,155; Groton Bridge & Mfg. Co., Groton, N. Y., were awarded the contract for \$1,125.

Glen Moore, Pa.—The grand jury has recommended the erection of a new bridge over the Brandywine at Wallace street.

Guelph, Ont.—The Board of Public Works has recommended that \$4,600 be spent on building two bridges over Speed River, one of which is to be of stone.

Keyesport, Ill.—It has been voted to build a highway bridge over the Kaskaskia River.

Lewiston, N. Y.—The United States Senate has passed the bill authorizing a bridge to be built over the Niagara River at Lewiston.

Lowville, Pa.—The Berlin Iron Bridge Co. has been awarded the contract for building a bridge over French Creek for \$1,600.

Macon, Ga.—Bids will be received until May 29 by the Commissioners of Bibb County for building an iron bridge across the Ocmulgee River. The bridge will be of two spans of 170 ft. each with two viaducts of 60 ft. each. The contractor will be required to give bonds in double the amount of his bid, with securities for the faithful performance of the contract. W. G. Smith is clerk.

Middlebourne, W. Va.—Bids will be received till May 15 for building an iron bridge over Point Pleasant Creek, one over Pursley Creek, and one over Buck Run. D. Hickman is clerk of the county court.

Napa, Cal.—R. H. Pithie, of St. Helena, Cal., has been awarded the contract for building a stone bridge over Putah creek for \$19,980.

New Berne, N. C.—The Atlantic & North Carolina Railroad will replace the bridge recently burned across the Trent River with an iron one.

New Orleans, La.—The contracts for four steel bridges on the Gulf & Ship Island Railroad have been awarded to Bowles & Dearborn, Hennen Building, New Orleans.

Redley, Cal.—Borings are being made for the piers of the bridge to be built over Kings River by the San Francisco & San Joaquin Railroad.

St. Louis, Mo.—The Senate Commerce Committee at Washington has reported favorably the bill for bridge over the Mississippi at St. Louis. An amendment states that the bridge is not to be nearer than half a mile to the existing bridges.

Steelton, Pa.—The County Commissioners have awarded the contract for the new iron and steel bridge over the Pennsylvania canal at Franklin street, to Nelson & Buchanan, of Chambersburg, for \$3,080. The bridge will have one 63-ft. span, and will have a 20-ft. roadway and two 6-ft. sidewalks.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Great Northern, quarterly, 1½ per cent. on the preferred stock, payable May 1.

Kansas City, St. Louis & Chicago, quarterly, 1½ per cent. on the preferred stock, payable May 1.

Manchester & Lawrence, 5 per cent., payable May 2.

Nashua & Lowell, 4½ per cent., payable May 1.

Pennsylvania, semi-annual, 2½ per cent., payable May 29.

St. Paul, Minneapolis & Manitoba, quarterly, 1½ per cent., payable May 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Boonville Railroad Bridge Co., annual, company's office St. Louis, Mo., May 16.

Burlington, Cedar Rapids & Northern, annual, Cedar Rapids, Ia., May 26.

Calgary & Edmonton, special, Windsor Hotel, Montreal, Que., June 10.

Canada Southern, June 5.

Chicago & North Western, annual, company's office, Chicago, June 4.

Chicago, St. Paul, Minneapolis & Omaha, annual, company's office, Hudson, Wis., June 8.

Delaware & Hudson Canal, annual, company's office, 21 Cortlandt street, New York, May 12.

Des Moines & Fort Dodge, annual, company's office, Des Moines, Ia., June 4.

Detroit, Lansing & Northern, annual, company's office, Grandledge, Mich., May 13.

Grand Rapids, Lansing & Detroit, annual, company's office, Grandledge, Mich., May 13.

Kansas City Elevated, annual, company's office, corner Fifth street and Virginia avenue, Kansas City, May 12.

Keokuk & Des Moines, annual, company's office, Des Moines, Ia., June 3.

Missouri, Kansas & Eastern, annual, company's office, St. Louis, Mo., May 16.

Missouri, Kansas & Texas, annual, company's office, Parsons, Kan., May 20.

New York & Harlem, annual, company's office, Grand Central Station, New York City, May 19.

Pittsburgh, Fort Wayne & Chicago, annual, company's office, Pittsburgh, Pa., May 20.

St. Louis & Kansas City, annual, company's office, St. Louis, Mo., May 16.

Turtle Creek Valley, annual, company's office, Broad Street Station, Philadelphia, May 12.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Society of Civil Engineers* will hold its annual convention at San Francisco, beginning on or about June 30.

The *American Society of Mechanical Engineers* will hold its annual convention at the Southern Hotel, St. Louis, May 19 to 22. The programme of the meeting was published in the *Railroad Gazette* of April 24.

The *Traveling Engineers' Association* will hold its next annual meeting at Minneapolis, Minn., commencing Sept. 8.

The *Master Car Builders' Association* will hold its next convention at Congress Hall, Saratoga Springs, N. Y., beginning June 17. The rates at Congress Hall are \$3 a day for single rooms.

The *Master Mechanics' Association* will hold its next annual convention at Congress Hall, Saratoga Springs, beginning June 22.

The *Roadmasters' Association of America* will hold its next annual convention at Niagara Falls, beginning on Sept. 8.

The *Railway Signalling Club* will meet on the second Tuesday of the months of January, March, May, September and November, in Chicago. Mr. George M. Basford, is secretary, The Rookery, Chicago.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Tuesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Tuesday in each month, at 8 p. m. The headquarters of the society are at 1736-1739 Monadnock Block, Chicago. The business meetings are held on the first Wednesday at its rooms. The meetings for the reading and discussion of papers are held on the third Wednesday at the Armour Institute, Thirty-third street and Armour avenue.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Boston Society of Civil Engineers* meets at 715 Tremont Temple, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 4 p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second Tuesday of each month except during July and August.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the

Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary of the association.

The *Engineers' Club of Columbus, (O.)*, meets at 12½ North High street, on the first and third Saturdays from September to June.

The *Engineers' and Architects' Association of Southern California* meets each third-Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The *Engineers' Society of Western New York* holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except June, July, August and September.

The *Engineers' Society of Western New York* meets on the first Monday of each month at the Society's rooms in the Buffalo Library.

Western Society of Engineers.

At the meeting of the society held on May 6, a paper by Mr. George E. Thomas, on "Foundations," was read.

Railroad Surgeons.

The ninth annual convention of the International Association of Railway Surgeons was held at St. Louis, April 29 and 30 and May 1. The following officers were elected for the ensuing term: President, Dr. Frank J. Lutz, St. Louis; Secretary, Dr. Cassius D. Westcott, Chicago; Treasurer, Dr. E. H. Lewis, Kansas City, Mo.

The Wisconsin Society of Engineers and Surveyors.

This society was organized at Appleton, Wis., last week and the following officers were elected: N. H. Smith, of Clintonville, President; B. F. Dorr, Antigo, Vice-President; F. J. Harriman, Secretary and Treasurer; C. H. Vinal, of Appleton; H. W. Leach, of Oshkosh; E. A. Little, of Menasha, and the President and Secretary, Directors. It was decided to hold the next meeting on the first Tuesday in March, 1897, the place of meeting to be decided by the directors of the society.

Iron and Steel Institute (British).

The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George street, Westminster, on Thursday and Friday, the 7th and 8th days of May, 1896. The following is a list of the papers that are expected to be read and discussed:

On the Rate of Diffusion of Carbon in Iron. By Prof. W. C. Roberts-Austen, C. B., F. R. S. (Member of Council).

On Some Alloys with Iron Carbides. By J. S. de Benneville (Philadelphia).

On Mild Gas as Applied to Steel Making. By John H. Darby (Brymber).

On Hot Blast Stoves. By B. J. Hall (Westminster).

On the Hardening of Steel. By H. M. Howe (Boston). Adjourned discussion.

On the Introduction of Standard Methods of Analysis. By the Baron Hanns Japtner von Jonstorff (Neuberg, Austria).

On the Production of Metallic Bars of Any Section by Extrusion. By Perry F. Nurey (London).

On Mr. Howe's Researches on the Hardening of Steel. By F. Osmond (Paris).

On the Treatment of Magnetic Iron Sand. By E. Metcalf Smith (Member of the New Zealand House of Representatives).

On the Making of the Middle Lias Ironstone of the Midlands. By E. A. Walford, F. G. S. (Banbury).

Engineers' Society of Western Pennsylvania.

The Engineers' Society of Western Pennsylvania held its first meeting in the new quarters, 410 Penn avenue, on Tuesday evening, 28th ult. W. G. Wilkins, the President, occupied the chair. William Metcalf addressed the society on the changes and development in engineering during the last 30 years. He described the advantages of power machinery and the reduction in expenses resulting from its introduction. He said that not one-tenth of the work done to-day could have been turned out 30 years ago with the facilities and appliances at command at that time. Mr. Metcalf pointed out the improvements in transportation and communication during the past quarter of a century.

A resolution was adopted returning thanks to Allegheny Councils for the free use of the Carnegie Library which the society enjoyed during the past two years. Also a series of resolutions pertaining to the new charter proposed for the city, the principal one to the effect that the Director of Public Works should be an engineer of established professional and administrative ability and that in the opinion of the society it will be improbable to obtain such a director by direct vote of the people as contemplated in the new charter and further that the salary proposed, namely \$4,000 per annum, is entirely inadequate to secure the services of an engineer of desired ability.

The society's new quarters are handsomely furnished, and a large lecture hall and library, parlor, office and small rooms for periodicals and transactions form part of the conveniences.

PERSONAL.

—Mr. F. W. Huidekoper, of New York, has been elected President of the Chicago, Peoria & St. Louis road, in place of Mr. Henry W. Putnam, Jr.

—Mr. C. W. McGuire, Auditor of the Peoria, Decatur & Evansville road, has been appointed to a similar position on the Louisville, Evansville & St. Louis road.

—Mr. Henry M. Shepard has been appointed Superintendent of the Unadilla Valley road in New York state, to succeed Mr. Charles N. Chevalier, who resigned on May 1.

—Mr. John C. Lee, Assistant Superintendent of the Western division of the Michigan Central, with headquarters at Michigan City, Ind., has resigned. He has been with the company 16 years.

—Mr. H. S. Burgesser, who for two years has been Division Freight Agent of the West Shore road in Buffalo, has been promoted to be Assistant General Freight Agent, with office in New York.

—Mr. George W. N. Reed, formerly Treasurer of the Pratt & Whitney Co., of Chicago, has been elected Vice-President and General Manager of the firm. He has been succeeded as Treasurer by Mr. J. C. Stirling, of Chicago.

—Mr. James McLaughlin, recently with the Philadelphia Engineering Works, Limited, has been elected Secretary and Treasurer of the Barr Pumping Engine Co., of Philadelphia, of which Mr. W. W. Lindsay is General Manager.

—Mr. Aldace F. Walker, Chairman of the Atchison, has just filed his resignation as one of the receivers of the St. Louis & San Francisco road, an office to which he was appointed soon after his appointment as the receiver of the Atchison.

—Mr. G. McD Nathan has been appointed Auditor of the New Orleans & Western road. Mr. Nathan is now in the office of the Commercial Agent of the Southern Pacific at Atlanta, Ga., but was previously in railroad work at New Orleans with the Texas & Pacific.

—Mr. George T. Jarvis, who has been recently appointed Receiver of all the divisions of the Louisville, Evansville & St. Louis Consolidated road, will also act as General Manager of the company. That office was also held by one of the former receivers, Mr. E. O. Hopkins.

—Mr. William Wainwright has been appointed General Assistant of the Grand Trunk railroad, with special duties under the General Manager. The office of Assistant General Manager of the Grand Trunk which Mr. Wainwright held when Mr. Seargeant was General Manager, has been abolished.

—Mr. Thomas D. Sheridan, who has represented the traffic department of the Grand Trunk in various capacities in Buffalo since 1863, retired from the post of District Passenger Agent last week, and was succeeded by Mr. James D. McDonald, who will have charge of both the Buffalo and Niagara Falls districts.

—Mr. C. K. Wilber, Western Passenger Agent of the Lake Shore & Michigan Southern, has been promoted to be Assistant General Passenger Agent of that company, his office remaining at Chicago. Mr. T. S. Timpson, Eastern Passenger Agent of the road at Buffalo, N. Y., has been promoted to be General Eastern Agent.

—Mr. S. H. Wenck has been appointed Auditor of the Nickel Plate line, with headquarters at Buffalo, as the successor of Mr. P. E. Nolan, resigned. Mr. Wenck was connected with the auditing department of the Erie road for nearly 20 years, latterly as Auditor of the Erie Dispatch, an office which he resigned in November, 1894.

—Mr. W. Cockfield, Locomotive and Car Superintendent of the Interoceanic Railroad, of Mexico, has resigned that position to return to the Mexican Central, with which he was connected before going to the Interoceanic road in August last. He has been appointed Master Mechanic of the San Luis Division of the Mexican Central, with headquarters at San Luis Potosi.

—Mr. Charles L. Brown, General Freight Agent of the Lexington and Big Sandy divisions of the Chesapeake & Ohio Railroad, died suddenly at his home in Lexington, Ky., May 5. He was General Freight Agent of the Kentucky Central for 25 years, and was its General Freight and Passenger Agent when it was sold to the Louisville & Nashville. He then went to the Chesapeake & Ohio.

—Mr. H. F. Bickell, Superintendent of the Sandusky division of the Lake Erie & Western has been appointed Assistant General Superintendent to succeed Mr. Geo. T. Jarvis. Mr. S. P. Cramer, Superintendent of the Peoria division, will take Mr. Bickell's place on the Lima division and Mr. H. A. Boomer, of the Toledo, St. Louis & Kansas City, will succeed Mr. Cramer on the Peoria division.

—Mr. W. W. Peffers, Assistant Auditor of the New York, Pennsylvania & Ohio, resigned on May 1 to engage in business at Cleveland. Mr. Peffers was one of the oldest officers of the "Nypano," his service dating back to 1869. He was then a clerk in the engineering department at Meadville, Pa. When the offices were removed to Cleveland about 1880 he entered the auditing department of the company.

—Mr. J. C. Cassell, Superintendent of the Lynchburg division of the Norfolk & Western, is to be placed in charge of that part of the line from Roanoke to Norfolk, Va.; Major E. L. DeBarry, now Superintendent of the eastern division from Crewe to Norfolk, is to take the place of Capt. N. M. Osborne, at Norfolk, who is to succeed Col. William Lamb, the general agent of the Castner & Curran Coal Co. at Norfolk.

—Mr. Elmer Lovejoy, station agent of the Portland & Rumford Falls road at Mechanic Falls, Me., has been appointed Superintendent of the road, with offices at Rumford Falls, to succeed Superintendent L. L. Lincoln, resigned. Mr. Lovejoy will also act as train dispatcher. He was station agent for the Maine Central for eight years, and on the opening of the Portland & Rumford Falls road became station agent for that company.

—Mr. Frank J. Maus has been appointed General Agent of the Pennsylvania at Erie, Pa., and as such will have charge of the ore and coal business of the company at that port, as well as the general freight business of the company. Mr. Maus has been City Freight Agent of the Erie for 10 years. Heretofore the Pennsylvania's ore and coal business at Erie has been in charge of a separate agent, that policy having been in existence for over 30 years.

—Mr. C. A. Barnard has been appointed Assistant General Freight Agent of the Ohio Southern and Mr. F. E. Fisher Assistant General Passenger Agent of the same company. They have been connected with the road for some time and in their new positions will have charge respectively of the freight and passenger departments until a successor is appointed to Mr. L. R. Brockebrough, General Freight and Passenger Agent, who recently resigned.

—Mr. Adolph Butze, who has just been appointed General Purchasing Agent of the Grand Trunk road, was formerly in the service of the Missouri Pacific, the Louisville, New Albany & Chicago, and other roads. At one time he was Purchasing Agent of the Missouri Pacific, but recently he has been in the railroad supply business at St. Louis. The Grand Trunk heretofore has not had a Purchasing Agent, the department being in charge of the General Storekeeper.

—Mr. N. B. Kelly has been appointed Freight Commissioner of the Philadelphia Trades League, succeeding

ing Mr. Charles P. Hatch. Mr. Kelly was in the traffic department of the Pennsylvania Railroad for 11 years, but for the last 16 months has been Freight Claim Agent of the Erie & Western Transportation Company. Mr. Hatch is now Commissioner of the Tide Water Bituminous Steam Coal Traffic Association, the offices of which is in the Provident Building, Philadelphia.

—Mr. George DeShields, of Cumberland, Md., for many years Superintendent of the hotels of the Baltimore & Ohio Railroad, has just resigned and that office has been abolished. The hotels owned and managed by the Baltimore & Ohio at Cumberland, Md., and Grafton, W. Va., have been leased and will no longer be directly managed by the company. Hereafter the management of the company's restaurants and dining rooms, etc., will be under the direct charge of the General Manager.

—Mr. S. S. Neff, Chief Engineer of the Lake Superior & Ishpeming Railroad, in charge of the construction of that road in the northern peninsula of Michigan, has resigned, and it is stated that all the subordinate officers of the company at Marquette, Mich., have also resigned with Mr. Neff. The trouble was due to a disagreement with Mr. John M. Egan, who was recently appointed Assistant to the President of the railroad, and as such placed in charge of the company's interests in Michigan.

—Mr. E. Q. Hopkins has again been appointed a receiver of the Louisville, Evansville & St. Louis by Judge Woods of the United States Circuit Court at Indianapolis. Mr. Hopkins was formerly one of the joint receivers of this company and General Manager of the road, but resigned a few weeks ago with his colleague as receiver, when Mr. G. T. Jarvis was appointed sole Receiver of the road. The present appointment by Judge Woods makes Mr. Hopkins' Assistant Receiver. His appointment was urged by the first mortgage bondholders.

—Mr. A. S. Dodge has resigned as General Traffic Manager of the St. Louis Southwestern, to become a member of the Board of Administration of the Southwestern Traffic Association. The duties of General Traffic Manager of the St. Louis Southwestern will be abolished. Mr. R. S. Davis, who has been Assistant General Freight Agent, being appointed General Freight Agent in charge of the freight traffic of this company. Mr. E. W. La Beaume, as General Passenger and Ticket Agent, will be in charge of all matters pertaining to the passenger traffic.

—Mr. Charles E. Sayre has been appointed City Freight Agent of the Lehigh Valley, at New York City. Mr. T. J. Klase, General Eastern Freight Agent, whose headquarters have heretofore been at New York City, has removed to Boston, and Mr. Sayre, who has been Assistant to Mr. Klase, will look after the interests of the freight department of the company at New York and vicinity. He has been with the Lehigh Valley for 20 years, nearly all of the time in the Freight Department. Since 1884 he has held responsible positions with the company in New York City.

—Mr. Peter P. Shelby, Assistant General Traffic Manager of the Great Northern, with headquarters at Seattle, Wash., has resigned. The resignation was caused by ill health. Mr. Shelby went to the Great Northern in 1889, having been previously General Manager of the Montana Central. He was Assistant General Traffic Manager, then General Traffic Manager. He went to Washington in 1892 as General Manager of the Washington lines of the Great Northern then building. For the last few years he has been in charge of the company's traffic affairs on the Pacific Coast and the company's ranking office there.

—Mr. Charles H. Doeblner, Master Mechanic of the Michigan Division of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed Master Mechanic of the Wabash road at Fort Wayne, Ind. He succeeds in this latter office Mr. F. W. Morse who has been appointed Superintendent of Motive Power of the Grand Trunk. Mr. Doeblner, after graduating from the University of Pennsylvania, entered the Fort Wayne shops of the Pennsylvania Company as a machinist and then served in various positions in the mechanical department of the Pennsylvania lines until his appointment as Division Master Mechanic of the "Big Four" in 1891.

—Mr. L. Rush Brockebrough, at present General Freight Agent of the Ohio Southern, is reported to have been appointed General Agent of the Baltimore & Ohio at Cleveland and Traffic Manager of the Cleveland Terminal & Valley road, a leased line of the latter company. Mr. Brockebrough has held his present position with the Ohio Southern since last autumn when the management of the company was entirely separated from that of the Cleveland, Akron & Columbus. He had been Traffic Manager of that road for several years and has held important positions in the traffic department of the Chicago & East Illinois and of the Cleveland, Cincinnati, Chicago & St. Louis.

—Mr. M. Gilleas, Assistant General Superintendent of the Illinois Central, with office at Memphis, Tenn., has been appointed Assistant General Manager of the Chesapeake & Ohio Southwestern by the receiver of that company. This appointment practically places the operation of the road under the direct charge of the Illinois Central, which now controls the line. The recent decision of the United States Supreme Court sustaining the claim of the state of Kentucky, that the road could not be leased by the Louisville & Nashville, permitted the Illinois Central to assume a more direct control of its operations, although the receiver will not be discharged for a number of months.

—Mr. Charles F. Parker, who was recently General Manager of the Cairo Short Line, now operated as a division of the Illinois Central, has been appointed General Agent of the St. Louis, Bellville & Southern road, in charge of its transportation and operating departments. The railroad of the company is about 15 miles long, reaching coal property owned in the same interest, and Mr. Parker has been appointed General Agent of the coal property as well. Mr. W. J. Karner, who was appointed General Manager of the railroad and coal property some months ago, has resigned, and Mr. Parker assumes the duties, retaining his office as General Agent of the Illinois Central at St. Louis.

—Mr. W. W. Finley has resigned the third vice-presidency of the Southern Railway to return to the Great Northern, of which he was General Traffic Manager until he went South to accept the commission of the Southern States Passenger Association. He held that office about a year until his election as Third Vice-President of the Southern Railway, in charge of its traffic department. Mr. Finley returns to the Great Northern as one of its vice-presidents. His title and duties have not yet been officially announced, but he will have charge of its traffic affairs, and we understand that his authority will be extended shortly to other departments. Mr. Finley is now about 43 years of age and

has been in railroad service nearly 25 years. His training as a traffic manager has been thorough and comprehensive and his career has certainly been very successful. He has held responsible positions on many Western roads, and has been chairman of several Western traffic associations, leaving the Western Passenger Association in 1892 to go to the Great Northern as General Traffic Manager.

—Mr. Luther Filmore, Superintendent of the South Pacific Coast road, which has been operated as a division of the Southern Pacific, has resigned that office and expects to go to Wyoming, where he has property, about June 1. Mr. Filmore is an uncle of the Manager of the Pacific system of the Southern Pacific, and has been Superintendent of the South Pacific Coast road since March, 1884. It is a narrow gauge line, formerly controlled by Messrs. Fair & Flood. Mr. Filmore's early railroad career, like that of other officers of the Southern Pacific, was on the Delaware, Lackawana & Western, in whose employ he was for 15 years. In 1889 he went West and became Division Superintendent on the Union Pacific from Cheyenne to Ogden.

The South Pacific Coast road will be consolidated with the Southern Pacific's Coast Division, a standard gauge line, when Mr. Filmore's resignation takes effect. Mr. James L. Frazier, Superintendent of that division, will then have jurisdiction over both lines. Mr. R. W. Baxter, Roadmaster of the South Pacific Coast Division, resigns with Mr. Filmore.

ELECTIONS AND APPOINTMENTS.

Central Ohio.—William A. Fisher, John W. Garrett and Douglass H. Gordon, of Baltimore, have been elected directors of the road, to succeed Walter B. Brooks, deceased, and Omum Latrobe and John G. Harvey.

Cleveland, Cincinnati, Chicago & St. Louis.—Frank J. Zerbe has been appointed Master Mechanic of the Michigan Division, with office at Wabash, Ind., vice C. H. Doeblner, resigned, to go with another company.

Grand Trunk.—The district passenger agencies at Detroit, Buffalo, Ogdensburg and Boston are to be abolished. George B. Oswald, District Passenger Agent at Ogdensburg, and M. J. Grace, at Boston, will be appointed Traveling Passenger Agents, the former with head office at St. Albans, Vt., and the latter at Portland, Me. At Boston the agent of the Central Vermont will look after the Grand Trunk's passenger business.

Mr. William Wainwright has been appointed General Assistant, and will perform such duties as may be assigned to him by the General Manager. Office at Montreal, P. Q.

John Taylor, General Storekeeper, having been superannuated, Mr. A. Butze has been appointed General Purchasing Agent, with office at Montreal, P. Q.

Great Northern.—H. A. Kimball has been appointed General Agent of the freight department at Minneapolis for the Great Northern & Eastern Minnesota. Mr. Kimball was formerly connected with the "Soo" road in a similar capacity in Minneapolis. He succeeds C. H. Russell, who resigned recently.

Gulf, Colorado & Santa Fe.—Bryan Snyder has been appointed Assistant General Freight Agent of this company, with headquarters at Dallas, Tex., and the office of Division Freight Agent, formerly held by him has been abolished.

Knoxville, Cumberland Gap & Louisville.—The jurisdiction of the general officers of the Southern Railway, of Mr. W. A. Vaughan, Assistant General Superintendent, and L. E. Wynne, Division Superintendent at Knoxville, Tenn., has been extended over this road, which is now operated by the Southern. Mr. H. G. Fraser, Auditor, and E. Fairfax, Treasurer, of the local company, who were appointed Assistant Auditor and Assistant Treasurer of the company respectively, when the property was transferred to the Southern Railway, have resigned, and the reports to those departments are hereafter to be forwarded to the auditing and treasury departments of the Southern Railway at Washington.

Louisville, Evansville & St. Louis.—George T. Jarvis, recently appointed Receiver, has assumed the duties of General Manager, with headquarters at Evansville, Ind. C. W. McGuire has been appointed Auditor and W. L. Taylor General Attorney.

Ohio Southern.—The following is a corrected list of the directors elected at the recent annual meeting: Daniel O. Dell, Stephen D. Boyer, E. L. Oppenheim and Archibald Smith, of New York City; James B. Townsend and C. H. Roser, of Lima; H. L. Chapman, Jackson, E. R. Thomas, New York; Walter B. Richie, Lima, O.

Philadelphia & Easton.—These officers have been elected by this company, referred to last week: President, Colonel Jamison, Philadelphia; Secretary, M. Coleman, Norristown, Pa.; Treasurer, J. H. Shelley, Richlandtown; Directors, John A. Ogden, Henry H. Souders, Quakertown; Charles E. Freed, James Shelly, Richlandtown; Dr. John J. Ott, Pleasant Valley; Henry Funk, Springtown and Abm. Hewitt, of Cooper & Hewitt, proprietors Iron Furnace, at Durham; Wm. Baker, Colonel Jamison, Philadelphia.

Portland & Rumford Falls.—E. L. Lovejoy has been appointed Superintendent, with office at Rumford Falls, Me., vice L. L. Lincoln, resigned, and will report to Mr. Waldo Pettengill, Vice-President.

St. Louis & Illinois.—The incorporators of this new company are E. M. Sloan, John G. Irwin, Oliver C. Look, William S. Combs, C. A. Ambrosius, H. S. Morrill, R. W. McAfee, E. G. Gerding, Mac D. M. Powell, A. M. Powell, of Collinsville, Ill.

St. Louis, Belleville & Southern.—W. G. Karner, General Manager, having resigned, the office of General Manager has been abolished. Mr. H. McCourt is appointed Superintendent, with office at Centralia, Ill.

Mr. C. F. Parker has been appointed General Agent at St. Louis, with office in the Laclede Building. He will have charge of all matters pertaining to the traffic and transportation departments at that point and will also have charge of the terminals at East St. Louis.

St. Louis Southwestern.—A. S. Dodge, having resigned as General Traffic Manager of this company to take service as a member of the Board of Administration of the Southwestern Traffic Association, that office has been abolished. Mr. R. S. Davis has been appointed General Freight Agent, in charge of the freight traffic. E. W. La Baume, as General Passenger and Ticket Agent, will have charge of all matters pertaining to the passenger traffic.

Union Pacific.—At the annual meeting of the stockholders at Boston, on April 29 the Directors were re-

electing with the exception that Alexander Millar, Secretary and Assistant Comptroller of the company, succeeds S. Endicott Peabody, and George Q. Cannon of Salt Lake City succeeds James Sharp as a representative of Salt Lake City interests.

Wabash.—C. H. Doeblner has been appointed Master Mechanic in charge of the Eastern Division, with headquarters at Ft. Wayne, Ind., vice F. W. Morse, resigned.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Coal River.—This company is making rapid progress with the preliminary work, and will be ready to begin actual construction next month. It was incorporated two months ago to build a road through the Coal River basin, in West Virginia, by Robert T. Olney, Roman Pickens, Thomas L. Brown, C. D. Hereford and others, all landowners in the Coal River basin and directly interested in its development. At St. Albans, last week, R. T. Olney was elected President; Roman Pickens, Treasurer, and Fontaine Brown, Secretary. The stockholders authorized the directors to contract for building the road as soon as the surveys are completed. It is the intention to let the first 16 miles to contract next month, if possible, which will carry the line from the Kanawha River, at St. Albans, to the mouth of Fork Creek, on Big Coal River, in Boone County.

Chicago, Lake Shore & Eastern.—This company, recently incorporated in Illinois, has leased the Calumet & Blue Island road and the lines operated by that company, and assumed possession of the properties on May 1st. These are the lines controlled by the Illinois Steel Company around Chicago, and comprise a large mileage of track connecting the various works of that company with the railroads running into Chicago, Milwaukee and Joliet.

Denver & Rio Grande.—The proposed extension referred to last week, are lines from Delta to Carbondale, and from Durango to the intersection of the San Juan River and the Navajo Meridian, in New Mexico. Separate companies will be organized to build the lines. One will be called the Rio Grande Delta Railroad Company, and the other the Rio Grande-Durango Southwestern. Each company is capitalized at \$250,000, and the incorporators for both companies are officers of the Denver & Rio Grande.

Detroit & Mackinaw.—The contract for the grading on the extension from Omer southwest to Bay City, Mich., 37 miles, has been let to Kennedy & Campbell, of Bay City, Mich. The contractor is required to complete the first seven miles by May 31, the next 10 miles by June 10, the next five miles by June 20, the fourth section of five miles by July 1, and the last five miles by July 10.

Flint & Pere Marquette.—The contract for the extension into Toledo, known as the Monroe & Toledo road has been let to H. A. Boedtker & Co., with office in the New York Life Insurance Co.'s Building, Chicago, and the contractors are now beginning active work. The new road begins 3½ miles north of Monroe, Mich., and extends southerly—passing through Monroe, about one mile west of the Lake Shore & Michigan Southern road, thence southerly and nearly parallel to the Lake Shore to its junction with the Ann Arbor road at Alexis, in Ohio, thence over the tracks of the Ann Arbor to its new station in the city of Toledo. The length of the new line will be 18.6 miles. The work is light, with maximum grades of 12 ft. per mile and 2 deg. curves. There are many small drains and bridges as the line crosses at right angles to the drift of the stream. The bridge work includes a thorough steel bridge, with two spans of 162 ft. each, and three small deck girders, one 44-ft., one 70-ft. and one 30-ft. The contractor is now busily supplying material for the drainage, and has parties in the field clearing, grubbing and grading. The whole work is to be completed ready for track-laying by Aug. 1, 1896. W. B. Sears, Chief Engineer of the railroad, is in charge of the work.

Florida Southern.—The officers of the Plant System, which now operates this road, have definitely decided to change the gauge of the road to standard. The preliminary work is to be commenced immediately, but the actual change of gauge will not be made until late in the summer. The line runs from Brooksville to Palatka, Fla., a distance of 145 miles. It is probable that a new line will be built on the northern end, from Gainesville to Evinston to shorten the line between those points.

Little Kanawha.—This company has secured a charter in West Virginia, the incorporators being S. L. Gould, Edward McCreery, William Bentley, W. A. McCash and J. Henry Fisher, all of Parkersburg, W. Va. The road which the company proposes to build will begin at Parkersburg, and extend by way of the Little Kanawha River Valley to Burnsville, Braxton County, W. Va. Wood County will hold an election to vote upon a proposition to subscribe \$175,000 to the capital stock of the road. A number of New York capitalists are said to be interested. The road is one which has been in contemplation among West Virginia timber and coal men for 10 years. The line has been surveyed several times, and the route is all ready for work to begin.

Mammoth.—A line about three miles long and standard gauge is to be built by James Cunningham and associates to connect the Mammoth mining properties in Southern Utah with the mills. The grading has already been commenced.

New Roads.—The projectors of what is known as the Glenjean Lower Loup Creek and Deepwater road, state that work will be commenced at once. The road is to begin on Upper Loup Creek, some six miles from Thurmond Station, W. Va., on the Chesapeake & Ohio, and then extend to White Oak branch, six miles, thence down Lower Loup Creek, 16 miles to Deepwater, a small town at the head of navigation on the Kanawha River. At Deepwater the company proposes to bridge the Kanawha to intersect the Kanawha & Michigan road.

Pecksport Connecting.—This company was organized in New York last week to build a railroad four miles long from Pecksport, Madison County, on the line of the New York, Ontario & Western, known as the Utica branch, to Morrisville, on the main line of the same railroad. The capital is \$40,000, and the directors are J. E. Childs, J. C. Anderson, R. D. Rickard, A. L. Parmelee, J. M. Fleming, J. M. Shedd, C. A. Draper and H. Munzie, of New York City, and George Marsden, of Middletown, N. Y. Bids for grading the road will be received by Mr. J. E. Childs, General Manager of the company, until May 16. The grading is to be completed in 60 days.

Roaring River & Stone Mountain.—This is the name to be given a new road which George W. Hinshaw, of Winston, N. C., and others contemplate building from

Roaring River, N. C., a station on Wilkesboro branch of the Southern to Stone Mountain, N. C., thence to Sparta, the county seat of Alleghany County, N. C., a distance of 30 miles. A survey has been made around Stone Mountain to a point 11 miles from Roaring River, and this section will probably be built first leaving the further extension of the road to Sparta to be decided on thereafter. The route is through timber lands.

St. Louis & Illinois.—Articles of incorporation were filed with the Secretary of State in Illinois by this company last week. It is proposed to build a road from near Madison, through Collinsville, to a point near O'Fallon, and from Collinsville to Lebanon, and; from Collinsville to Peters Station. The capital stock is \$100,000, and the principal office is located at Collinsville.

Santa Fe, Prescott & Phoenix.—The Congress mine, in the Weaver district, Arizona, is to be connected with this road by a branch four miles long.

Southern.—This company is now putting down 75 miles of 75-lb. and 80-lb. rails on the Piedmont Air Line and North Carolina Railroad divisions, between Washington and Charlotte, N. C. Other divisions will also be partly relaid with new rails. Stone ballast is also being put in over a large per cent. of the mileage of the company.

Electric Railroad Construction.

Ashland, O.—The Mansfield, Savanna & Wellington Electric road has been granted a franchise through the northwestern part of the county by the commissioners.

Atlanta, Ga.—The Collins Park & Belt Railroad Co. will extend its road from the present terminus at the Chattahoochee River to Iceville, a distance of half a mile. A brick arch will be built to carry the Western & Atlanta road tracks over those of this road.

Baltimore, Md.—The contract for building the Ilchester power house of the Columbia & Maryland Railway was awarded last week to S. & H. J. F. Adams, of Baltimore. General Manager Schoepf says that it is expected to have the Baltimore end of the line in operation by August.

Bristol, Pa.—Work was started last week on the power house for the new Bristol turnpike electric road, to be built from Poquessing Creek to Bristol, a distance of seven miles. The new line will connect at Poquessing Creek with the Holmesburg, Tacony & Frankford electric road, and when finished will give a continuous electric railroad from Bristol to Philadelphia.

Chicago.—The Englewood & Chicago Electric Railway Co. has placed contracts for the construction and equipment of a portion of its road. This company proposes to build about 60 miles of track which it will equip with storage batteries.

Cleveland.—The directors of the Cleveland, Wadsworth & Southern Electric Railway Co. have decided to increase the capital stock of the company from \$10,000 to \$600,000 in order to facilitate the building of the road. Right of way has been secured as far as South Brooklyn. The route of the projected road is through Sharon, South Road, Grangerberg, Remond's Corners, Hinckley and Royalton; and it is also intended to run a line east to Barberton. Another contemplated branch will extend to Akron. G. D. Hile and James L. Mauldin, of Cleveland, are reported as interested.

Nordhoff, N. J.—The Bergen County Traction Co. has been granted a franchise for an electric road through this village, near Fort Lee.

Monroe, Mich.—Councils have granted the Monroe, Lake Erie & Dundee Electric Railway Co. the right to construct its line into this town.

Moncton, N. B.—The Moncton Street Railway, Heat & Power Co. has been incorporated, with a capital stock of \$100,000, to build an electric railroad in Moncton and Lewisville.

New Haven, Conn.—The Fair Haven & Westville Railway Co. has begun the work of relaying three miles of single track at a cost of about \$25,000.

Philadelphia, Pa.—The contract for the construction of the New Castle & Wilmington Electric Railway has been awarded to J. L. Reed, of Philadelphia, and work will begin soon.

Pittsburgh, Pa.—The Monongahela Passenger Co. has been incorporated with a capital stock of \$12,000 to build an electric railroad on Greenfield avenue. James D. Culley is President.

Plattsburgh, N. Y.—The contract for building six miles of the new electric road in Plattsburgh has been let to Sanderson & Porter of New York.

Portland, Me.—The Portland & Cape Elizabeth Railroad Co. has petitioned the select men of Cape Elizabeth to extend its road about two miles through that town.

Port Jervis, N. Y.—A company has been formed by Philadelphia capitalists under the name of the Delaware Valley Electric Railway Co., which proposes to build an electric road from Port Jervis to Stroudsburg, Pa., a distance of 42 miles. It is said the contract for the road has already been awarded.

Royal Oak, Mich.—A franchise has been secured by the Oakland Railroad Co. to extend its road to Southfield through Farmington.

Toledo, O.—The Toledo & Maumee Valley Railway Co. will extend its road to Bowling Green through the towns of Waterville and Tontogany.

GENERAL RAILROAD NEWS

Atchison, Topeka & Santa Fe.—The company reports earnings for March as follows:

	1896.	1895.	1894.
Gross earn.....	\$2,271,863	\$2,329,547	\$2,380,938
Oper. exp.....	1,740,907	1,831,633	1,948,943
Net earn.....	\$534,656	\$497,914	\$434,993
P. c. exp. to earn.....	76½	78¾	83¾
Nine Months:			
Gross earn.....	\$2,277,611	\$2,713,337	\$2,691,082
Net earn.....	5,460,489	5,271,933	7,775,152

Baltimore & Ohio.—The Receivers have consented to allow the Baltimore Reorganization Committee to make such examination of the books and accounts of the company covering the years from 1888 to 1896, as may be desired. The Baltimore committee has employed Mr. Stephen Little to make the examination. He has been engaged in examining the company's accounts for the New York committee.

Cedar Falls & Minnesota.—The foreclosure sale for this road under the decree of the United States Circuit Court which has been previously published, has been fixed for June 14. The road is one of the leased lines of the Illinois Central which will acquire ownership of the property at the sale. The line is 70 miles long from Waterloo to Lyle, Ia. The decree for foreclosure was under a judgment for \$129,000.

Chesapeake, Ohio & Southwestern.—Receiver Boyle has been authorized by Judge Lorton, of the United States Circuit Court at Nashville, Tenn., to issue receiver's certificates to an amount not exceeding \$400,000. Part of the funds secured are to be used to pay interest on the outstanding first mortgage bonds which is shortly due, and the rest for the purchase of about 7,000 tons of heavy rails to replace light sections now in the track.

Chicago & West Michigan.—The company makes the following report of earnings for the year ending December 31:

	1895	1894	Inc. or dec.
Gross earn.....	\$1,724,047	\$1,596,518	I. \$127,529
Oper. exp.....	1,404,097	1,277,760	I. 126,337
Net earn.....	\$319,950	\$318,758	I. 1,192
Fixed charges.....	403,133	400,497	I. 2,636
Deficit.....	\$83,183	\$81,739	I. 1,444
Profit & loss sur.....	73,734	158,917	D. 85,183

Choctaw, Oklahoma & Gulf.—The plan for the issue of preferred stock has been accepted by more than enough security holders to make the plan operative. When the plan was announced in March last it was stated that more than 75 per cent. of the holders of the general mortgage bonds which would be retired by the proposed issue of preferred stock had accepted the proposal. The plan involves the issue of 80,000 shares of five per cent. preferred stock which will enable the company to extinguish its car trust and provide for various extensions, also reducing the annual fixed charges about \$110,000.

Cleveland, Cincinnati, Chicago & St. Louis.—The company reports the following earnings for March:

	1896	1895	1894
Gr as earn.....	\$940,362	\$1,102,301	\$,655,342
Oper. exp.....	745,731	816,889	804,910
Net earn.....	\$244,631	\$285,412	\$250,432
P. c. exp. to earn.....	75 1/4	74	76 1/4
Net nine months.....	\$2,679,408	\$2,531,184	\$,482,676

Erie.—The company reports earnings for March:

	1896	1895	Inc. or Dec.
Gross earn.....	\$2,461,225	\$2,474,295	D. \$13,070
Oper. exp.....	1,825,587	1,755,192	I. 70,395
Net earn.....	\$635,638	\$688,603	D. \$52,965
P. c. exp. to earn.....	74	72 1/4	I. 1 1/2
Net 3 mos.....	\$1,524,210	\$1,337,553	I. \$186,657

Included in the expenses of 1896 is one-twelfth of the entire taxes of the year.

Jacksonville, Tampa & Key West.—The United States Court for the Southern District of Florida has ordered the sale of the road postponed from May 6 to November 2. The second mortgage bondholders claimed that they could find a purchaser at the upset price of \$350,000, set by the court.

Louisville, St. Louis & Texas.—The Special Commissioner, under a decree of the United States Court, sold this property at Owensboro, Ky., on May 5, to James Helm, representing the committee of bondholders, composed of John M. Cook, Harry Weissenger, C. B. Van Nostrand and Oscar Fenley, for \$300,000. It is said that a new Board of Directors will be elected about June 1.

Norfolk, Albemarle & Atlantic.—This property was sold at foreclosure at Norfolk, Va., last week for \$190,000 to General Howard, of New York City, representing certain of the bondholders. The property sold included the railroad from Norfolk to Virginia Beach, about 18 miles, and the Princess Anne Hotel at Virginia Beach.

Norfolk & Ocean View.—Judge Hughes, of the United States Circuit Court at Norfolk, Va., last week appointed Mr. O. Emerson Smith, of Portsmouth, Va., permanent receiver of this road. Attorneys representing the present management of the road asked the court to appoint Major R. G. Banks as receiver. The road is about 12 miles long running out of Norfolk, Va., to the property at Ocean View, Va.

Norfolk & Western.—The Reorganization Committee announces that the deposits in this country and in Amsterdam and London, England, up to Saturday of last week were more than enough to make the reorganization plan effective. The committee announces further that the time for depositing securities under the plan without penalty has been extended to May 15.

Northern Pacific.—The earnings for February were:

	1896	1895	1894
Gross earn.....	\$1,150,030	\$938,606	\$915,094
Oper. exp.....	826,123	725,613	766,463
Net earn.....	\$323,907	\$209,993	\$148,631
P. c. exp. to earn.....	71 1/4	77 1/2	83 1/2
For eight months:			
Gross earn.....	\$14,308,236	\$12,292,136
Oper. exp.....	6,567,897	4,551,370
Net earn.....	54 1/2	63

The company earned net in February, 1896, \$260,560, in 1895 \$536,078, in 1894 \$433,681, in 1893 \$382,940, in 1889, \$427,485.

Pennsylvania.—The earnings of the lines east of Pittsburgh and Erie for March are reported as follows:

	1896	1895	1894
Gross earn.....	\$5,202,832	\$5,133,532	\$4,912,362
Oper. exp.....	3,203,310	3,619,910	3,255,612
Net earn.....	\$1,999,522	\$1,513,622	\$1,656,750
Net 3 mos.....	3,571,120	3,643,920	3,396,976

All lines west of Pittsburgh and Erie report a decrease in gross earnings of \$59,600; of net earnings a decrease of \$94,100. Lines west of Pittsburgh and Erie, directly operated, report gross earnings decreased \$36,400; expense increased \$15,800; net earnings decreased, \$52,200.

Philadelphia & Reading.—The decree of foreclosure of this property was signed by Judge Acheson, of the United States Circuit Court, at Philadelphia, last week. The decree provides for the sale of the foreclosure of the property of the railroad and of the coal and iron company, under the general mortgage of the company, at Philadelphia, at a date yet to be fixed.

St. Louis & San Francisco.—Judge Caldwell, of the United States Circuit Court, at St. Louis, has issued an order for the sale of this property at St. Louis, on a date yet to be fixed. The order of sale includes the company's road in all of the states in which it is located. No bid for less than \$1,250,000 will be accepted.

West Jersey & Seashore.—The final step in the plan to consolidate all the New Jersey lines of the Pennsylvania Railroad was taken at Camden, N. J., May 2, when meetings of the stockholders of the five roads affected were held at the company's offices in response to a call issued by the Board of Directors, and the consolidation was finally agreed upon. These roads are the Alloway & Quinton, the West Jersey, the Philadelphia, Marlton & Medford, the Chelsea Branch, the Camden & Atlantic and the West Jersey & Atlantic roads. The title of the consolidated lines is to be the West Jersey & Seashore. The capital stock of the new corporation is \$4,500,000.

Electric Railroad News.

Ottumwa, Ia.—The Ottumwa Electric Railway, Light, Power and Steam Co. has passed into the hands of J. H. Merritt as Receiver.

Rahway, N. J.—The Middlesex & Union County Traction Co.'s electric road and the Rahway Electric Light Works were sold last week to R. W. Deferest, of New York, for \$30,000.

Toledo, O.—The Toledo Electric Street Railway was sold last week to Blair & Co., of New York. The amount paid has not been made public. The new company assumes all indebtedness, which is large, there being two mortgages of \$1,750,000 and \$100,000. The road has 27 miles of track.

Winona, Minn.—The plants of the Winona General Electric Co. and Winona City Railway Co. have been purchased by Frank A. Seymour, for \$170,000 being paid for the former, and \$100,000 for the latter.

TRAFFIC.

Traffic Notes.

The Erie Railroad has four new observation-cars, one of which is run at the rear end of each limited train between New York and Cincinnati.

The South Eastern Railway of England is going to collect and deliver passengers' baggage, in a limited district of London, at one shilling a package, the money to be paid to the truckman.

It is reported that the boatmen on the Erie Canal have agreed upon a rate of 3 1/2 cents a bushel on grain from Buffalo to New York, and that they will maintain it through the month of May.

The Southern Express Company has superseded the Adams on the lines of the Southern Railway in Virginia, north of Richmond and Lynchburg. Mr. J. B. Hockaday has been appointed General Agent of the Southern Express at Washington.

The Railroad Commissioners of Massachusetts are to give a hearing May 13 to persons interested in the passage of a law regulating the transportation of bicycles. The Governor of Pennsylvania has been asked to state whether or not he would sign a bill requiring bicycles to be carried free.

The Board of Control of the Joint Traffic Association will meet in New York to-day (May 8). The Canadian Pacific, Norfolk & Western, Toledo, St. Louis & Kansas City, Lake Erie & Western, and the Cincinnati, Hamilton & Dayton railroads have been invited to attend the meeting and to join the Association.

All of the railroads out of New Orleans have made a reduction of three cents per 100 lbs. in the rate on sugar in carloads to Lincoln, Neb. It is said that this is about equal to a reduction which has been made secretly for a long time. Soon after the Brown decision one road made the reduction openly and the rest followed.

Judge Simonon, in the United States Circuit Court at Charleston, S. C., has dismissed the bill of the Interstate Commerce Commission asking for an order of the Court to compel the Northeastern and other railroads to comply with the Commission's order made a year ago to reduce rates on the shipments of the truck farmers.

The New York Produce Exchange has appropriated \$5,000 to prosecute, before the Interstate Commerce Commission, or the courts, its demand for a reduction in the freight rate on grain from the West to New York.

The business men of Spokane have raised \$5,000 to continue the prosecution of a case they now have pending before the United States District Court, in which it is sought to compel the railroads to make more favorable freight rates to and from that city. The Spokane Freight Association applied to the County Commissioners for assistance in this matter and secured from them an appropriation of \$500, with the promise of more money if needed.

Powers of the Interstate Commerce Commission.

The United States Circuit Court for the Middle District of Tennessee in a recent decision (Interstate Commerce Commission v. Louisville & Nashville) lays down numerous rules which ought to be followed by the Interstate Commerce Commission in making investigation of rate questions. Some of these we quote. The Commission having, in a proceeding instituted on its own motion, ordered, after investigation, that the defendant should not charge more than certain maximum rates on coal from Kentucky mines to Nashville, Tenn., and the carrier having refused to obey the order, the Circuit Court was asked by petition to enforce the same.

The Court says: The jurisdiction of the U. S. Circuit Court is limited to an approval or disapproval and to an enforcement or refusal to enforce an order of the Commission. The court has no authority to modify the order of the Commission. An order made by the Commission is essentially an administrative order, and is not final or conclusive in the sense of a court judgment or decree. And an order of the U. S. Circuit Court, enforcing an order of the Commission, does not change its character or make it a final judgment. The function of the Commission is both quasi-judicial and administrative in its nature.

The Commission is required to make reports in writing in respect to complaints made to it. Such reports must include the findings of fact upon which the conclusions of the Commission are based, and such findings so made are to be deemed *prima facie* evidence as to each and every fact so found in any judicial proceeding thereafter had. It was the intention of Congress that the procedure before the Commission should substantially conform to that before a court charged with the duty of finding the facts, and giving judgment thereon, or to the investigation and report of a referee, or special master in chancery, passing on both facts and law. The fact that the Commission is composed of men of ability and experience, selected with reference to their particular qualifications for the effort, and whose entire time is devoted to questions arising under the act, gives to its findings and opinion great weight. But, in order that the finding and opinion of the Commission shall have the value

intended, it should conform to the purpose of Congress in requiring such proceedings. Its opinion or report should show what the issues in the case are, and what facts it finds in regard to such issues. It is not sufficient for the report of the Commission to be made up of mere conclusions with respect either to law or fact. It should make suitable reference to the evidence where there is a conflict in the proof, and show how the Commission settles the disputed fact; or if the evidence in regard to any fact is undisputed, it should be so stated by the Commission. Where, in a given case, it is the duty of the Commission to receive and take into account evidence of certain facts, its failure to do so is error of law. And so, where an issue of fact is raised before the Commission, its failure to dispose of it is an error of law.

The Commission has no power to make rates; and especially has the Commission no power to order that rates from a given point to one city shall bear a certain relation to the rates from the same point to another city.

It is impossible to exercise a jurisdiction, such as is conferred by the Act to Regulate Commerce, by any process of mere mathematical or arithmetical calculation. When you have a variety of circumstances differing in the two cases, you cannot say that such a difference of circumstances represents or is equivalent to such a fraction of a penny difference of charge in the one case as compared with the other. A much broader view must be taken, and it would be hopeless to seek to decide a case by any attempted calculation.

A railroad company may lawfully charge lower rates on coal in the summer months, in order to keep its coal cars and coal crews employed during that season of the year, provided that such rates be offered in good faith to all persons upon equal terms.

Chicago Traffic Matters.

CHICAGO, May 6, 1896.

Recently Chairman Midgley ruled that the Chicago-St. Paul lines must not join the Ogdensburg Transit Company in any lower through lake and rail rates from New York to St. Paul than those agreed upon and in effect by the other water lines. The agreed lake and rail rates New York to St. Paul are on the basis of 84 cents first-class. The Ogdensburg company claimed a 10-cent differential under this, was refused, and put in a 44-cent tariff New York to Chicago. Mr. Midgley's ruling is that this tariff is irregular and the Chicago-St. Paul lines must demand full local rates. Northwestern merchants are vigorously protesting, and Mr. Midgley is likely to withdraw his order.

The total receipts of live stock at the Union Stock Yards, Chicago, for the month of April were 21,765 cars, an increase of 4,036 cars over last year, and the total shipments for the same month were 6,499 cars, an increase of 599 cars over April of last year. The following table shows the receipts and shipments over the different lines for the month:

RECEIPTS, CARS.			
C. & B. & Q.....	5,615	Wabash.....	1,017
C. & N. W.....	4,415	Chi. & G. W.....	768
C. M. & St. P.....	3,133	A. T. & S. F.....	731
C. R. I. & P.....	2,185	Others.....	773
Ill. Cent.....	1,949		
C. & A.....	1,182	Total.....	21,765
SHIPMENTS, CARS.			
L. S. & M. S.....	932	Chi. & G. T.....	1,992
Pitts., F. W. & C.....	583	Balt. & O.....	402
Mich. Cent.....	518	Others.....	628
Erie.....	1,128		
N. Y., C. & St. L.....	331	Total.....	6,499

Some of the Chicago-Kansas City lines, have never been satisfied with the action taken last fall lengthening the running time between these two cities 45 minutes, and the Santa Fe and Alton have now reduced the running time 25 minutes.

Chairman Caldwell, of the Western Passenger Association, has given the Wisconsin Central line authority to meet the competition of the Chicago Great Western in making second-class tickets good in first-class sleeping cars.

The transcontinental roads have voted down a proposition to issue signature forms of tickets in blank to resident agents of connecting lines.

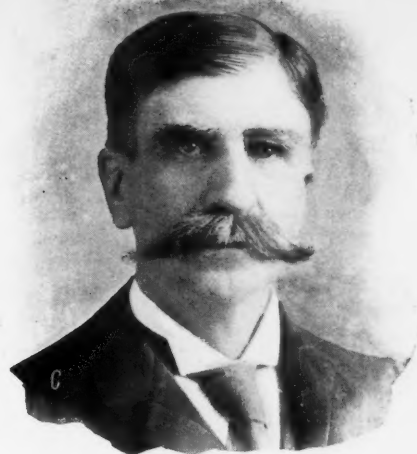
The Federal grand jury now sitting in Chicago will investigate the alleged dressed beef trust, also, it is said, alleged discriminations in eastbound freight rates. The Government authorities have been very unsuccessful in serving subpoenas on desired witnesses. Out of 14 subpoenas issued it is said but three have been served. These three are A. R. Fay, Traffic Manager for Swift & Co.; C. E. Davis, Confidential Agent for Nelson, Morris & Co.; and C. L. Thomas, General Freight Agent of the Chicago & Erie road. The Government has employed a private detective agency to locate the persons who have thus far evaded summonses. The investigation is being carried on with great secrecy.

The Board of Control of the Joint Traffic Association has ruled that on and after May 18 the maximum allowance for transferring oats at private elevators in Chicago and at all outside junction points shall be \$1.50 per car, and \$1 per car on corn and wheat. The present allowance of all lines is \$2.50 on oats, and \$1.50 on corn. The board has also ruled that where grain is cleaned and blowed in railroad companies' elevators a charge shall be made for the work.

Eastbound rates continue to be firmly maintained. Shipments by water last week amounted to 50,276 tons, of which 45,902 tons were grain, compared with 178,533 tons for preceding week. Total rail shipments last week, not including live stock, amounted to 63,830 tons, compared with 61,899 tons for the preceding week, an increase of 1,931 tons, and against 53,285 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	WEEK TO MAY 2.		WEEK TO APRIL 25.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central.....	6,214	9.7	5,132	8.3
Wabash.....	5,773	9.1	5,313	8.6
Lake Shore & Mich. South.....	8,568	13.4	2,269	3.4
Pitts., F. W. & C. & St. Louis.....	7,639	12.1	9,071	14.7
Pitts. Cn. & St. Louis.....	7,397	11.4	7,668	12.4
Baltimore & Ohio.....	5,894	9.1	5,159	8.3
Chicago & Grand Trunk.....	5,761	9.0	5,715	9.2
New York, Chic. & St. Louis.....	5,362	8.4	4,797	7.7
Erie.....	9,547	15.0	7,266	11.7
C. C., C. & St. Louis.....	1,805	2.8	3,509	5.7
Totals.....	63,830	100.0	61,899	100.0

Of the above shipments 2,760 tons were flour, 31,276 tons grain and millstuffs, 9,412 tons provisions, 8,816 tons dressed beef, 1,758 tons butter, 1,076 tons hides, and 6,047 tons lumber.



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